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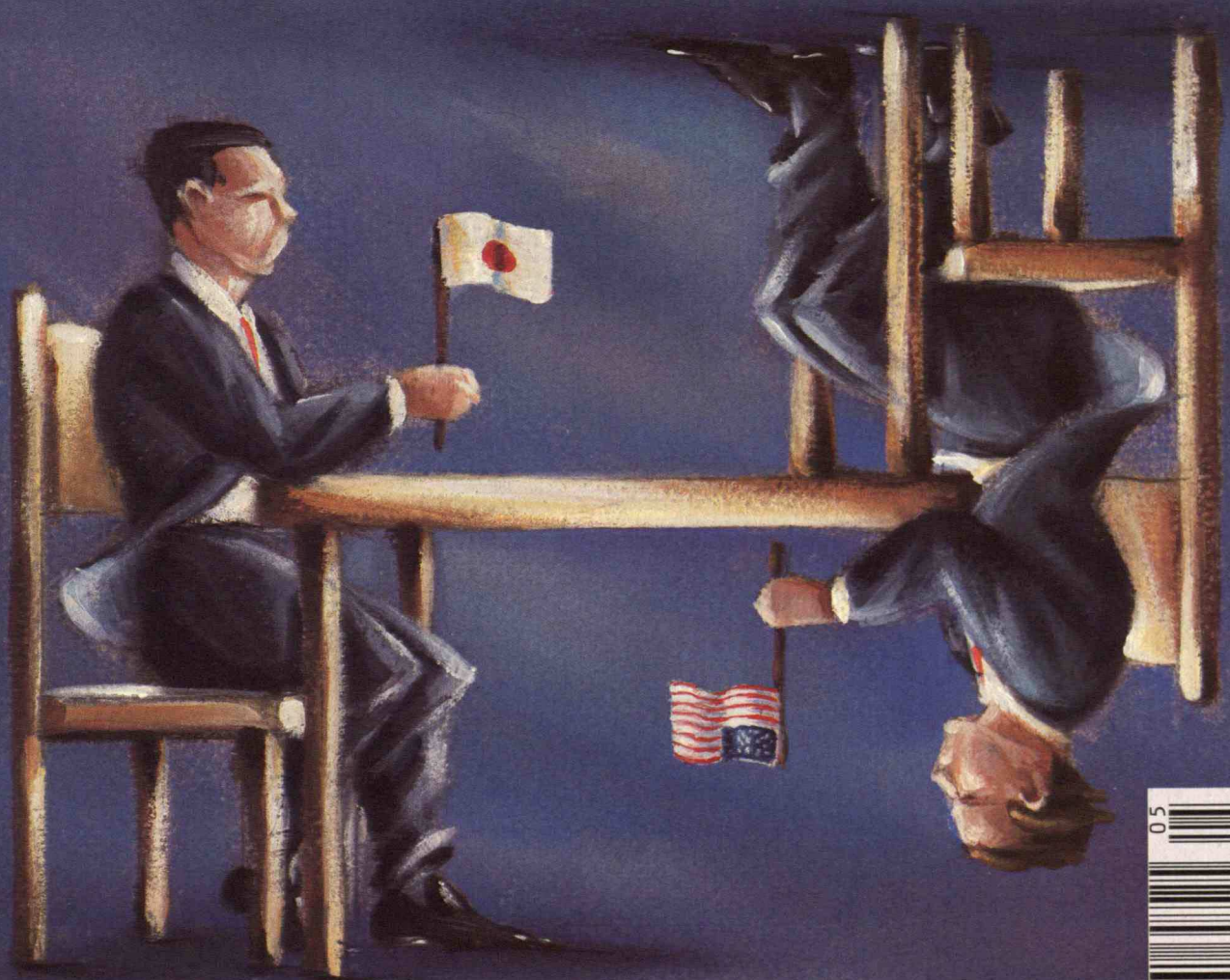
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MAY/JUNE 1988

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HOW THE JAPANESE TURN ECONOMICS UPSIDE DOWN

ADVICE FROM A U.S. TRADE NEGOTIATOR



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review
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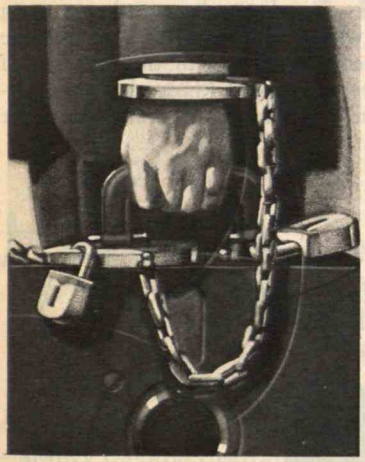
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FIRST LINE

FROM THE EDITOR

Celebrating Our Gatekeepers

How and where do we find *Technology Review*'s authors?

Sometimes the question is a prelude to a complaint, sometimes to a compliment. But it's asked often enough to suggest that many readers would welcome a brief answer.

Some of our articles appear unexpectedly as inquiries, synopses, or even complete first drafts. We read all such submissions, which people in the editorial trade describe as coming "over the transom." Often enough this process rewards us. Examples in recent issues are Joel S. Hirschhorn's advocacy of waste reduction (*April 1988*), Dorinda Dallmeyer's doubts about protectionism and the semiconductor industry (*November/December 1987*), and Arnold Kerr and Byron Pipes' case for more down-to-earth engineering education (*October 1987*). Still, the proportion of unexpected submissions that ultimately appears in the *Review* is relatively low.

Occasionally readers or friends tell us about manuscripts looking for a publisher. Such a suggestion brought us Stephen W. Korthals-Altes's analysis of the proposed aerospace plane—originally a master's thesis—in our January 1987 issue.

Most articles appear in the *Review* because the editors have asked authors to write them. Our request might be based on a paper or seminar we've heard or seen. Sometimes we respond to an article in a magazine whose audience is very different from the *Review*'s. Many authors appear here because colleagues recommend them to us. Recent examples are the article on energy policy by Michael Lynch (*November/December 1987*) and the piece on the changing character of the SDI program by Peter Clausen and Michael Brower (*October 1987*).

In most cases, generating articles for *Technology Review* depends heavily on networks. It was just 20 years ago that Professor Thomas J. Allen of M.I.T. first identified in a *Technology Review* article the type of people who are the stars of networks such as ours. Studying information flow through R&D laboratories, Allen discovered the existence of what he called "gatekeepers." These are the small minority of people who are information seekers and communicators, the prime movers behind the networks in any organization in which they operate.

The *Review* depends greatly on its gatekeepers. Readers who number among them will recognize themselves in these comments. Others with the instincts of gatekeepers should know that membership in this company is not closed—far from it.



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LETTERS

Marketing Energy



OIL DILEMMAS

In "The Next Oil Crisis" (*November/December 1987*), Michael Lynch is mistaken in believing that the "lessons" Americans were supposed to have learned from the oil crises of the 1970s were "largely wrong." The world indeed does have limited reserves of fossil fuels, and they most certainly will run out one day.

Moreover, we were absolutely right to "make the most of existing supplies" by increasing "the energy efficiency of buildings, vehicles, and industry." Because we have done so, we are in better shape now and better able to deal with another oil crisis. We were also right to "develop alternative sources of energy," although we haven't done it "as quickly as possible" but have let it drop by the wayside because of cheap oil, lack of determination, and lack of cooperation between government and industry.

The statement that "our energy needs will not be threatened over the next few decades" left me dumbfounded. Lynch notes that proven world oil reserves total 700 billion barrels—but what he doesn't say is that two-thirds of those reserves belong to Persian Gulf countries.

Lynch also fails to mention that nuclear energy has helped move the United States and several of our allies toward greater energy self-sufficiency. Next to coal, nuclear energy is the largest source of U.S. electricity, and has saved the burning of large quantities of oil and natural gas. Furthermore, it's often our cheapest source of electricity. Coal costs about 16 percent more; natural gas 58 percent more; and oil 79 percent more.

Finally, Lynch says that "the biggest mistake in planning for emergencies is blindly assuming that past problems will recur." As the airline industry, the nuclear power industry, Wall Street—you name it—know, the worst mistake we can make in planning is blindly assuming that past problems will not recur.

RONALD E. LAMB
Gaithersburg, Md.

Michael Lynch has overlooked the fact that problems with our electricity supply could undermine our ability to weather the next oil crisis.

Replacing oil with electricity did a great deal to help our society trim overall energy use after the 1973 oil embargo. From 1973 through 1986, use of non-electric energy fell by 13 percent while electricity use grew by 37 percent. Moreover, the GNP over the same period grew by 35 percent: electricity allowed us to cut overall energy and oil use without sacrificing economic productivity and growth.

The trend toward increased use of electricity is continuing; demand in this country in 1987 grew about 4 percent. It is virtually certain that within the next few years electricity demand will outstrip the current generating capacity, and as this happens, electrical plants themselves will start eating into the oil supply. The reason is that although utilities have cut their oil use, the oil-fired capacity they have switched off now constitutes about half of the total capacity they are holding in reserve to meet future demand. When utilities have used up the coal and nuclear capacity they have built to replace oil, they will turn on these oil-fired plants, essentially negating the oil savings of the past dozen years.

Their next step will be to bring new plants on line as fast and as cheaply as possible. The easiest and least expensive to build are gas- and oil-fired plants. The obvious solution is to build more new plants now, when the pressure is not so intense, but unpredictable and often punitive regulations are keeping utilities from doing this.

GILBERT J. BROWN
Lowell, Mass.



Michael Lynch credits conservation for reducing the threat of future oil crises. It is therefore surprising that when he turns to policy suggestions, he ignores the single most effective option: strengthening efficiency standards for automobiles and extending them to light and medium trucks. Nothing else would do so much to reduce oil use, and do it so surely. The record of the first half of the 1980s shows clearly

that automotive technology responds to political stimulus, and analysis shows that improving auto and light-truck fuel efficiency from the current 27.5 miles per gallon to, say, 40 miles per gallon is likely to be as cost-effective as it is politically sensible.

DAVID B. BROOKS
Ottawa, Canada



Mr. Lynch says that during the 1979 oil situation "motorboat owners were given the same access to 'emergency' oil supplies as hospitals because of their powerful lobbying in Washington." I would have rewritten the statement as follows:

"Fearful of reactions from the housing and vacation-travel industries, officials proposed regulations that would curtail only one recreational activity in the event of an emergency—boating. Use of RV gas-hogs would be allowed to continue, and trips to beaches or ski lodges would not be affected. The officials were surprised at the response from the boating community, which pointed out the absurd unfairness of this approach. They responded by withdrawing the proposed regulations."

ANDREW G. SWANSON
Williamsburg, Va.

The author responds:

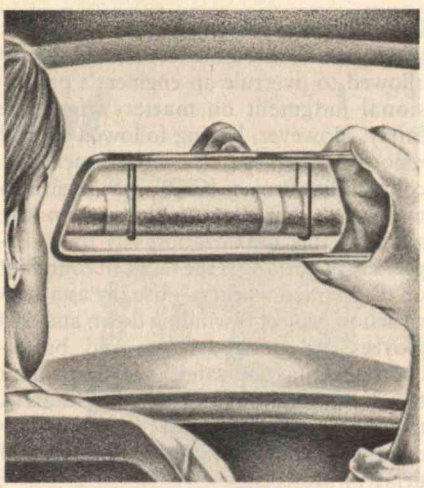
The writers make a number of valid points but overlook the main thrust of the article—namely, that an oil crisis is a short-term phenomenon, reflecting changes in the ability to supply oil. Preventing a disruption from becoming a crisis means either replacing lost capacity or reducing demand. Conservation and fuel-switching often make economic sense and reduce the economic impact of an oil price increase, but once supplies are disrupted, the role of conservation and fuel-switching is much more circumscribed. Conservation generally occurs *after* the price rises, and contrary to what Mr. Lamb suggests, nuclear power plants will certainly not be brought on line during a crisis.

In fact, there are physical limits to our resources, but they are meaningless, especially in the context of oil crises. We have always faced "limits" and have always overcome them. Our great-grandparents would have been as justified in decrying the limits on available land as we are in fearing that our own resources are limited.

In the 1970s we experienced problems with our supplies of oil, natural gas, and electricity, but there was no single "energy crisis," merely an unfortunate confluence of regulatory, logistical, and political problems. There will be more such problems in the future (and Mr. Brown correctly identifies the electric utility industry as a potential trouble spot). However, in seeking to prevent or ameliorate the next oil crisis, we must be careful not to spend a dollar now to save a dime later.

As for Mr. Swanson's comment, he seems to confuse giving someone special access with denying someone equal access.

Finally, I want to make a correction in the chart that appears on page 41 of the article. The upper line should be labeled "capacity." The space between the two lines represents surplus capacity.



ASBESTOS AWARENESS

In "Asbestos: Hindsight Is 20/20" (*July 1987*), Samuel C. Florman suggests that the nation has gradually developed higher standards for worker safety largely because we can now afford them. I disagree. In my opinion, having the money to do something and actually doing it are two distinctly different things. The expanding coverage of the asbestos story and the resulting public awareness of the issues may be even more critical than the availability of funds in accounting for any improvements that may have occurred.

LEO UZYCH
Wallingford, Pa.

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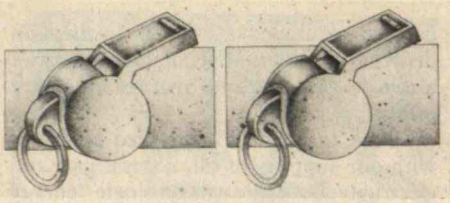
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PROTECTING WHISTLE-BLOWERS

Rosemary Chalk makes a lot of cogent remarks about the trials and tribulations of whistle-blowers (*"Making the World Safe for Whistle-Blowers," January 1988*). But I believe the world will never be truly—or even largely—"safe" for those with the guts or chutzpah to expose apparent wrongdoing. Let's face it: the sort of person who acts improperly will not always respond well when presented with evidence of it. Lamentably, many of those affected by whistle-blowing may wish to just get rid of the disturbance. So the whistle-blower rather than the wrongdoer may become the target of animosity.

LEO UZYCH
Wallingford, Pa.

I agree in principle with Rosemary Chalk's thesis that decision makers should not be allowed to overrule an engineer's professional judgment on matters of public safety. However, having followed several reported activities of the Government Accountability Project (GAP) with regard to nuclear power projects, I question the methods this organization has used. Especially disturbing is the tactic of rounding up disgruntled workers—usually as a construction project is winding down and employees are being let go—and broadcasting claims of safety violations and fraud. Rather than resolving allegations as they come up, GAP times its announcements to provide maximum impact on and delay of projects.

The claim that GAP represents the public interest is arguable. The next time *Technology Review* publishes this kind of article, the editors should stamp the words "political advertisement" in the margins of the pages.

DONALD A. DUBE
New Britain, Conn.

The author responds:

The key issue is the substance of the allegations made by GAP, not the organization's tactics. The *Wall Street Journal* recently quoted Alfred Mazzorana, a senior vice-president with Dean Witter Reynolds, as saying that GAP "has an incredible record of being right, and it has cost utilities and investors a ton of money." In 1987 a Nuclear Regulatory Commission (NRC) attorney stated that GAP "has seen to it that the public health and safety are protected." And in testimony before the House Committee on Interior and Insular Affairs, NRC official William J. Dircks acknowledged that his agency's investigation of safety concerns at the Zimmer nuclear station in Ohio was triggered by GAP's efforts.

Technical staff concerned about layoffs and their economic future have little incentive to engage in actions that may erode the fiscal strength of their employer. But when safety and quality assurance are at stake, these same people have consistently demonstrated their willingness to take risks and make sacrifices.

MEXICAN HIGH TECH

The Center for U.S.-Mexican Studies at the University of California applauds your publication of Harley Shaiken's important article on high-technology transfer from the United States to Mexico (*"High Tech Goes Third World," January 1988*). However, we wish that you had made it easier for your readers to obtain the complete study from which the article was drawn.

The 127-page study is *Automation and Global Production: Automobile Engine Production in Mexico, the United States, and Canada* by Harley Shaiken with Stephen Herzenberg (Monograph No. 26, Center for U.S.-Mexican Studies, 1987). Copies, at $10.00 plus $2.00 postage, can be ordered from the Publications Department, Center for U.S.-Mexican Studies, D-010, University of California at San Diego, La Jolla, CA 92093.

WAYNE A. CORNELIUS
La Jolla, Calif.

Wayne A. Cornelius is the director of the Center for U.S.-Mexican Studies at U.C., San Diego.

ECONOMIC SELF-DEFENSE

In "Why the Dollar Will Fall" (*November/December 1987*), Lester Thurow prescribes a single cure for a complex problem. For several years, economists have been saying that a falling dollar will cure, or at least greatly reduce, the trade deficit. But instead our overseas competitors have taken advantage of the situation to buy our real estate and industry. This insures that an ever-increasing portion of our fu-

ture earnings will leave the country.

Also, our Asian trading partners subsidize their exports in ways that put U.S. manufacturers at a severe disadvantage. For example, in addition to eliminating taxes on goods shipped out of their countries, they provide grants and low-interest loans for research and development. At the same time, Asian nations erect gigantic barriers to imports, including duties, quotas, and outright prohibition. These are often made even more impenetrable by bureaucratic red tape. The result is that there are no U.S. manufacturers of some products (VCRs and digital disk players) and few suppliers for others (TVs and stereos).

Hand-wringing economists rarely observe that we hold many cards we could play to reduce our trade deficit. For instance, as their best customer, the United States is responsible for the prosperity of Japan, Taiwan, Korea, Singapore, and Hong Kong. To coerce them into free trade, we should threaten that prosperity.

Controlling our budget deficit would require additional taxes; however, some taxes could do double duty in lowering both the budget and trade deficits. A tax on oil, which should have been imposed over 10 years ago, would have this effect. An import duty on goods from those traders that restrict our exports would also reduce both deficits. Moreover, it could be used as a bargaining chip to pressure our opponents into eliminating their import tariffs and quotas.

Finally, we could ease antitrust laws and encourage research, development, and modernization of plants. Where necessary we could eliminate our taxes on overseas shipments to meet the competition. A large portion of our R&D talent has been taken over by the military, but this, too, could change. Our competitors would just have to pick up a larger share of their own defense.

J.W. SHAW
Basking Ridge, N.J.

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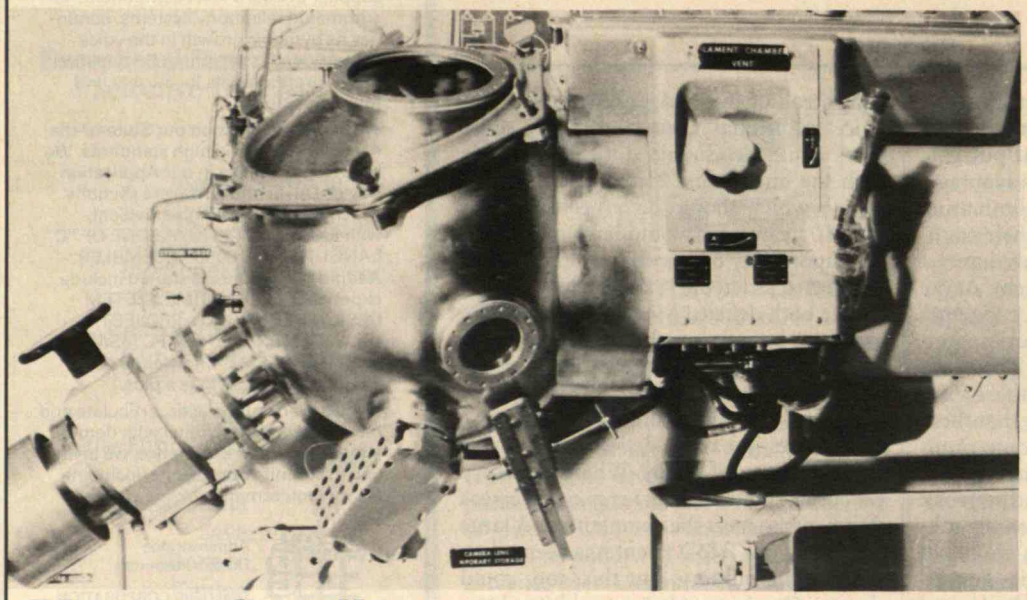
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Skylab astronauts test-burned samples of material in this furnace. Such experiments could prevent repeats of the Apollo fire that killed three people (above).

Blazing Satellites

Richard Custer worries about fires—in outer space. He is concerned that many "so-called fireproof space materials have never been tested in a microgravity environment."

Custer is associate director of the Center for Firesafety Studies at Worcester Polytechnic Institute (WPI) in Massachusetts. The center, which has developed fire-safe designs for nuclear submarines, polar icebreakers, and high-rise buildings, is now thinking about the U.S. space station, scheduled for launch in the late 1990s. The station, far larger and more complex than previous space missions, poses special challenges for fire-safety engineers.

Robert Friedman, an aerospace engineer at NASA's Lewis Research Center in Cleveland, Ohio, agrees that fire safety in space is cause for concern. Lewis is one of the few places that conducts even simple earth-based tests of microgravity fire safety, and as Friedman points out, "there's been no practical experience with fires in space. We don't really understand how flames spread in microgravity, how to extinguish a fire, or how to clean up after one."

Research on the subject is crucial because "we want to encourage experiments and commercial activity" on the space station, Friedman says. If NASA strictly limits the flammable material—such as books—researchers can bring into space, "they may not want to go up for two months or more."

The only prolonged space-based combustion experiments to date occurred in 1974 aboard Skylab 4. Astronauts ignited small pieces of mylar, nylon, polyurethane foam, teflon, and paper in Skylab's 65-percent-oxygen atmosphere. According to J. Howard Kimzey, who directed the experiments while he was at NASA's Johnson Space Center, the most dramatic test was the burning of a nylon sheet the size of a quarter.

The flame was surprisingly small, and it "burned for more than 11 minutes until an astronaut got bored and put it out," Kimzey says. An identical nylon sample on earth would burn up in about a minute. Not only could a slow fire in space pose a threat by spreading, but materials such as foam rubber used in walls could smolder undetected while emitting toxic fumes.

WPI's Custer describes an accident scenario unique to microgravity: a leaking flammable liquid could create a cloud of droplets that might be ignited by static electricity. As experiments at Lewis have shown, the droplets could shrink and explode into other burning droplets, setting off a "chain reaction that might be hard to control." Friedman adds that even a spilled powder could form an explosive cloud. In normal gravity, a cloud would disperse quickly, but in space it would linger.

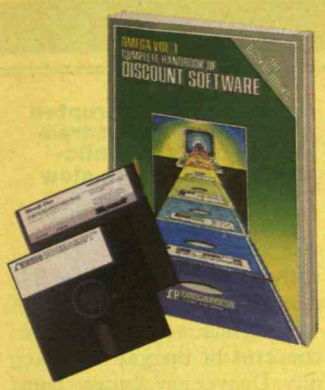
Grounded Research

Friedman, Kimzey, and Custer propose that NASA run space-based experiments on spontaneous combustion and fire detection. One goal would be designing reliable detectors. Says Friedman, "The current generation of fire detectors has never been tested in space, and we haven't figured out a good way of doing so."

Custer remarks that "there has never been a realistic test of extinguishing agents in microgravity. Sprays may not go to the right place or may get there too late." Moreover, Halon 1301, the active chemical in the shuttle's fire extinguishers, is highly toxic and corrosive. Even if it puts out a fire, scientists have no way to decontaminate the spacecraft. "You can't just throw hazardous chemicals overboard," Custer says.

Because manned space flights have been postponed since the Challenger disaster, all fire-safety experiments are conducted on the ground or in airplanes. Jets flying parabolic paths can simulate weightless conditions for about thirty seconds. Two "drop towers" at the Lewis Research Center—75 feet and 500 feet high—can simulate weightlessness for up to five seconds as a material falls to a thick, shock-absorbing pile.

PHOTOS: NASA



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Drop-tower experiments with velcro illustrate the limits to existing models for predicting how substances would burn in microgravity. According to Custer, the velcro fibers burst into flame, expelling small burning fragments.

Despite the limited research base, fire safety in space has improved. The Mercury and Gemini astronauts were their own fire detectors, and a water-filled gun for rehydrating food was their "fire-suppression system." The Apollo missions added a foam fire extinguisher, but no smoke detectors.

A major advance occurred after an Apollo capsule exploded on the launch pad during ground tests in 1967, killing three astronauts. In the 100-percent-oxygen atmosphere of early spacecraft, materials considered safe proved highly flammable. Space shuttles now carry fire detectors and portable and fixed fire-suppression systems. In addition, the oxygen content and pressure of the atmosphere in modern spacecraft are usually similar to those on earth.

When shuttle flights resume, NASA will conduct combustion and flame-spread experiments. And the Center for Firesafety Studies has scheduled a test to determine the time and energy needed to ignite substances in microgravity. Custer hopes to use that knowledge to devise ground-based test procedures and to construct models that can predict how materials burn in space. "Once we know how much energy it takes to ignite things, we can develop 'intrinsically safe designs' that separate ignition sources from combustible matters." □

STEVE NADIS is a frequent contributor to Trends.



Controversy has erupted over using contact tracing, a standard public-health strategy, to slow the spread of AIDS.

Door Knocking for AIDS

The scene is familiar in the world of public health. A health-department nurse arrives at your front door, tactfully breaks the news that you have been exposed to a sexually transmitted disease (STD), and leaves information about free and confidential testing and treatment. Public-health agencies have used this process—known as "active contact tracing"—for over 40 years to control STDs.

Lately, a storm of controversy has erupted over applying contact tracing to the spread of AIDS. Proponents argue that it is a time-tested public-health strategy. Critics respond that although well-intentioned, contact tracing carries the threat of government intrusion into private lives.

Twelve states now require officials to notify some or all sexual contacts of a person who tests positive for the human immunodeficiency virus (HIV), which causes AIDS. Physicians and public-health officials solicit the names of the contacts; and state or local health workers then notify the people named, encourage them to be tested for HIV, and provide counseling on safe-sex practices.

However, some public-health authorities believe that contact tracing may not be appropriate for AIDS. "Other STDs are not nearly as stigmatized as AIDS is," notes Andrew Sorenson, associate dean for academic affairs at the Johns Hopkins School of Hygiene and vice chair of Maryland's Governor's Council on AIDS.

Because the informant can remain anonymous, critics argue that a great potential for abuse exists. People could be named maliciously, suggests Mark Senak, director of legal services for the New York-based AIDS service organization Gay Men's Health Crisis. Those people would suffer emotionally, and if the information were leaked to insurers, they could lose health coverage.

The charge that contact tracing violates privacy angers some clinicians. "I am outraged," exclaims Dr. Thomas Vernon, executive director of the Colorado Department of Health. Colorado has one of the country's most aggressive contact-tracing programs. "What is being stated is that an individual who was exposed and may be infected has no right to know that. I think that is the ultimate invasion of privacy."

Vernon believes "very strongly that the duty to warn a third party who may have been exposed is a higher ethic." He adds, "When we have in place a process that preserves confidentiality, privacy is a bogus argument." To facilitate this protection, Colorado has enacted a law penalizing any health worker who releases information with a $3,000 fine and/or 24 months in jail.

This has not allayed the concerns of the gay community. Denver gay activist Tom Witte says that past discrimination prevents many gay men from trusting such assurances. "Whether or not that's well founded, it's a real fear. I know that it has kept the majority of men here from using the state health services."

The Only Vaccine?

Others question whether contact tracing for AIDS is worthwhile regardless of the privacy issue. Sorenson asks if "it is defensible to do contact tracing for a disease for which there is no known treatment." And criticism is greatest regarding programs that make contact reporting mandatory for anyone who tests positive for HIV. In North Carolina, the only state so far to take this step, the penalty for failure to comply could be two years in jail and an unlimited fine.

Moreover, even advocates concede that contact tracing may be inefficient in areas with a high prevalence of HIV infection. Dr. Stephen Schultz, New York City's deputy commissioner for epidemiology and prevention services, explains, "It doesn't score as high as many other ways of reaching the infected populations." Nevertheless, New York City began a contact-notification program last spring. "We pursue the program because we feel it is important in the education process," says Schultz.

Contact tracing may be most effective in reaching people who are unaware that they are at high risk, such as the heterosexual female partners of bisexual men. According to Schultz, "Contact

PHOTO: *GAY COMMUNITY NEWS*

notification is the only way to reach them." Thus, San Francisco's contact-tracing program is aimed solely at heterosexuals.

Rather than opposing all contact tracing for AIDS, gay health advocates have generally been ambivalent. In Minnesota, Eric Engstrom, executive director of the Minneapolis AIDS project, believes the program that state health officials have established is "carefully thought out." But he notes "a high level of mistrust among many of the people they are trying to serve." Despite the health department's "outstanding record of protecting the confidentiality of their sources, there was a perception of mistrust . . . and some very real discrimination issues." Engstrom thinks public-health agencies need to address those concerns.

In New York, on the other hand, Senak is skeptical of the motives behind contact tracing. It "gives people the illusion that they're doing something . . . when in fact the government is not doing much at all." He thinks it far more important for the partners of HIV-positive people to be "already so well educated about AIDS that they're not doing the things that will get them infected."

Nevertheless, HIV contact tracing is likely to be a basic component of the national effort to control the spread of AIDS. Vernon concludes, "The fact that we don't have a drug to cure people who are contacted and that we don't have a vaccine against AIDS is all the more reason why it is important that we reach these individuals and counsel them. . . . The point is that counseling is our only vaccine." □

DAVID GOODMAN is a freelance journalist in Boston.

Testing Physicists' GUTs

In an abandoned mine one-half mile below Minnesota's Soudan Park, collaborators from the University of Minnesota, Tufts University, Argonne National Laboratory, and England's Oxford University and Rutherford-Appleton Laboratory are stashing 1,100 tons of corrugated iron sheets. The scientists want to learn whether protons, once thought indivisible, actually disintegrate, as current theories suggest.

Tufts physicist Anthony Mann thinks that if these atomic particles do decay, "the implications are dire." Atoms and the structures they make up would be ephemeral, and eventually "conventional matter as we know it would vanish."

The fate Mann describes is not impending—it would be trillions of years away. As Steven Weinberg, Nobel laureate physicist at the University of Texas, Austin, points out, "The most interesting implications are not in the future, but in the past." Proof of proton decay would advance the search for a grand unified theory (GUT) to explain how nature's basic forces were one at the moment the universe began. GUTs predict that protons should decay into more fundamental particles with a rush of energy strong enough to push them at enormous speeds over a distance of as much as a meter.

University of Minnesota physicist Marvin Marshak stresses the need for experiments to test GUTs. "Some of this is almost an expression of faith, that there ought not to be separate fundamental forces—that the universe can't be that complicated somehow." Understanding the enormous force that binds protons together might mean "you could get energy out of anything—out of stone, dirt," he adds. In fact, much of the funding for the work in Minnesota—$10 million—is coming from the U.S. Department of Energy. The British government is contributing $5 million to the five-year experiment.

Proton Sign-In

If the effort succeeds, it will be the first time proton decay has been recorded reliably. The reason the scientists have to use 1,100 tons of iron as a detector is that proton decay, if it occurs at all, is extremely rare. Researchers in Ohio, Japan, India, and Italy have failed to observe a single incident. When none were seen in 7,000 tons of water monitored in an experiment near Cleveland, Ohio, the estimated proton lifetime was raised from 10^{29} years—a one followed by twenty-nine zeros—to 10^{31}.

Mann thinks the advanced detector the scientists in Min-

The 1,100 tons of corrugated iron to be buried deep in a Minnesota mine could help scientists prove that protons decay.



PHOTOS: ARGONNE NATIONAL LABORATORY

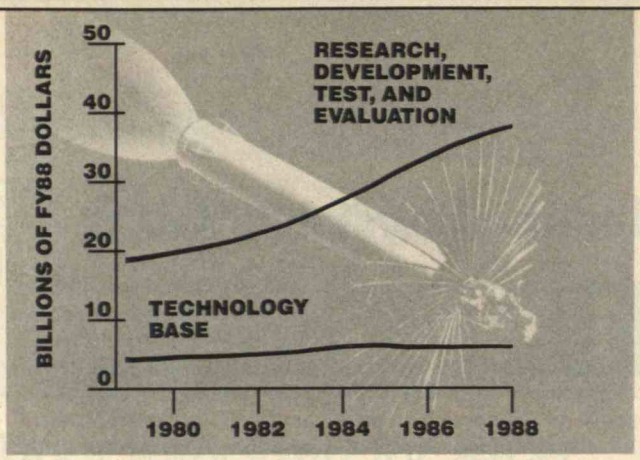
nesota will use significantly improves the chances of seeing decay. An elaborate system will monitor the trillions of protons and neutrons in the iron—waiting for one to explode. The 1,100 tons of iron to be placed in the mine by 1990 should contain enough protons and neutrons to yield more than 60 incidents of decay a year, he says. Study of an initial 200-ton portion of the experiment begins in June.

To detect decay, plastic tubes filled with a mixture of argon and carbon dioxide are placed in the spaces between the sheets of corrugated iron. The particles created by the disintegration of a proton would strip electrons off atoms in the gas, leaving a "signature." Computer-guided electronics will monitor the gas a million times a second.

The iron is buried far underground to shield it from cosmic rays and the trillions of neutrinos that penetrate the earth's atmosphere from outer space. However, the physicists consider the few cosmic rays that sneak through as a bonus. Since those particle interactions in argon-gas detectors are easily differentiated from the debris of erupting protons in iron, the experiment will in a sense be a "telescope" that will contribute to cosmic-ray and neutrino astronomy.

Neutrinos from the Supernova 1987A explosion hit the Cleveland detector last year, and finding them advanced theories about what happens when a star explodes into a supernova. Mann calls such serendipitous discoveries "manna from heaven" astronomy. □

DAVID GRAHAM is a Knight Science Journalism Fellow at M.I.T.



Military research funding has grown, but not for basic work. Critics charge that this trend threatens U.S. security.

The Pentagon and Basic Research

Despite the seven-year, trillion-dollar-plus U.S. defense buildup, some powerful Washington voices argue that basic military research has been shortchanged. According to the Senate Armed Services Committee, this has eroded "our long-term ability to sustain a qualitative edge over potential adversaries in our defense systems." Commenting on the 1988 and 1989 budgets, the committee expressed concern "that the [Defense] Department is inadequately funding the technology base"—long-term exploration of scientific principles and engineering concepts.

Technology-base funding is part of a section of the Department of Defense (DOD) budget called research, development, testing, and evaluation (R, D, T, AND E). The $37 billion allocated to R, D, T, AND E in fiscal-year 1988 covers almost all weapons-development spending. Two R, D, T, AND E categories—research and exploratory development—comprise the technology base, which includes projects in propulsion, math, advanced materials, biotech, and computer science. Other categories fund testing and development for hardware geared to specific weapons.

Many analysts—liberals and conservatives—think basic research is critical to U.S. security. Such programs anticipate Soviet breakthroughs and lay the groundwork for advanced military technology. Liberals believe basic research helps the United States maintain its technological lead, so that fewer weapons will be needed. Conservatives support the work as part of an overall defense buildup. Both point out that basic research has been key to developments such as integrated-circuit semiconductors. William Perry, undersecretary of defense for research and engineering under Carter, says, "It is hard to find an example of any system which didn't have its incubation in the technology-base category."

The Senate committee's worries stem from the fact that technology-base funding has gone flat since 1980, even as the whole R, D, T, AND E budget has increased 98 percent. After inflation, DOD was spending slightly less in 1988 on basic research than in 1981. Although basic research accounted for 2 percent of the budget in 1980, the figure is half that today.

The decline has several causes. First, as retired Gen. Robert T. Marsh, former head of the Air Force Systems Command, notes, "Anything in the defense budget that promises results only downstream tends to be given lower priority."

Moreover, the Pentagon has chosen not "to improve scientific understanding of technologies which could form the foundation of future military systems," according to Stephen Alexis Cain, an analyst with the liberal Washington-based Center for Budget and Policy Priorities. In *The Defense Budget Squeeze,* he writes that "the highest priority of the R&D buildup has been to develop a new generation of military hardware." He argues that emphasizing expensive weapons is an attempt to ensure continued huge DOD budgets.

Priorities and Categories

Kim Holmes, an analyst with the conservative Heritage Foundation, defends the Pentagon priorities. He says, "The Soviets are catching up not because they do basic research better, but because they turn technology into weapons systems a lot faster than we do."

Moreover, the Pentagon denies neglecting basic research. Ronald L. Kerber, until recently deputy undersecretary of defense for research and advanced technologies, argues that "DOD contributions to the national technology base are far larger" than the narrow budget definition. In particular, Kerber says that many programs funded as advanced development are actually basic research. This category, which includes most SDI funding, has grown more than 150 percent since 1980. Kerber believes many SDI programs are classified as advanced development only "because they are connected to a weapons system."

Ironically, some critics of

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DOD agree. University of California at Berkeley physicists Charles Schwartz and Paul Selvin think DOD controls too much research, especially at universities. They point out that DOD now accounts for 73 percent of all federally sponsored R&D, up from half in 1980. In *Science for the People* magazine, they write, "With $43 billion dedicated to *applied* research and development . . . the DOD is able to transform advances in basic research into practical weapons systems."

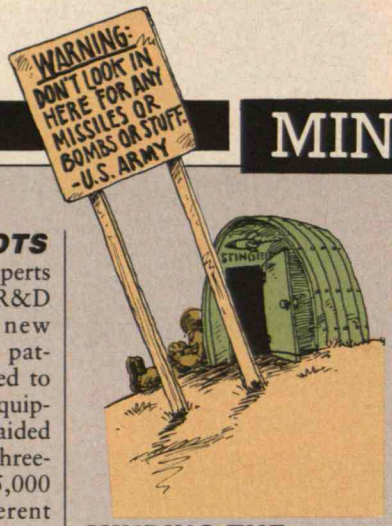
Nevertheless, Cain believes "it's stretching it a lot to say that [advanced development] is a basic-research category." And while conceding that some SDI money supports basic research, Richard DeLauer, undersecretary of defense for research and engineering from 1981 to 1984, says, "In general, SDI has eroded the technology base."

Spending patterns appear to support DeLauer. During the years technology-base spending increased—1981 to 1983—the category included $1.2 billion for 32 programs that eventually became part of the SDI effort. When these programs moved over to SDI, that money followed them and was not replaced. In 1988, the Pentagon has asked for 21 percent more money for SDI and a half percent less for the technology base.

Few critics believe the threat is immediate, but their concern is the long term. As one Senate Budget Committee staffer put it, "What will happen to the technology base when defense budgets aren't growing?" □

JEFFREY D. PORRO, a Washington writer, has worked on national-security issues in the State Department and as a U.S. Senate staffer.

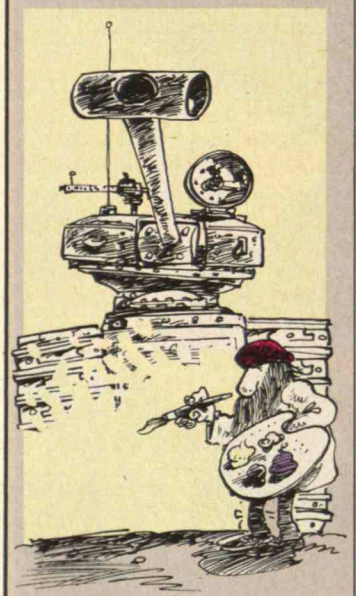
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ARMY'S NEW SPOTS

Countersurveillance experts at the army's Belvoir R&D center have created new three-color camouflage patterns that will be applied to all the service's tactical equipment. Using computer-aided design techniques, the three-year project devised 225,000 drawings for 834 different types of equipment.

Belvoir says the three-color patterns are more effective than the four-color ones the army has been using since the early 1970s. Old-fashioned camouflage employs a palette of colors intended to blend into nature. In the computer-generated designs, black patches fool the eye by breaking up the straight lines and sharp angles that characterize the silhouettes of artificial objects. The other two colors are added for a bit of close-range blending with the natural background.



MINDING THE STORAGE

Making military equipment invisible is all well and good, but the United States might pay more attention to how it stores its weapons, says Common Cause. That organization's magazine cites an October Government Accounting Office (GAO) study that inspected nine sites in Europe where conventional ammunition is stored. Six had poor security. Four of these failed to meet rules that require keeping the weapons in earth-covered bunkers protected by alarms and security guards.

In one glaring example, GAO reported Stinger missiles, anti-tank rockets, and hand grenades stored in lightweight metal sheds. According to Common Cause, "a few sheds had 'Stinger' stenciled on the outside, and some had doors that were propped shut because of broken locks."

STAR WARS SPIN-OFF

Regardless of whether "Star Wars—the defense project" yields civilian spin-offs, Georgia Tech and Emory University researchers have begun to exploit computer animation techniques from *Star Wars*—the movie. The team is developing a system that could give doctors a three-dimensional view of the human heart.

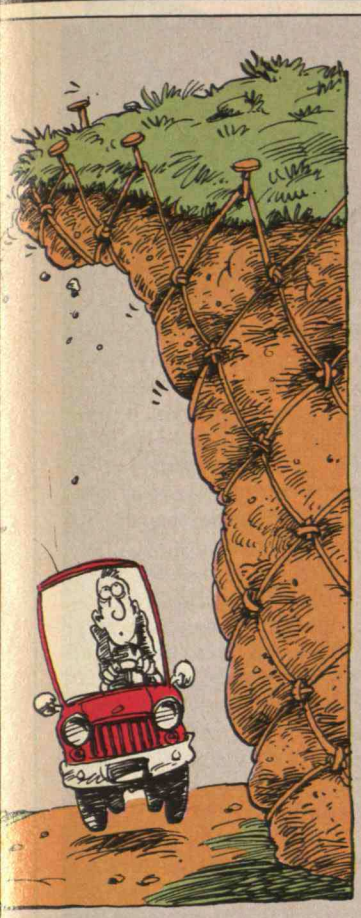
"Currently, doctors must look at two-dimensional X-ray images to form a 3-D mental picture," explains Dr. Norberto Ezquerra of Georgia Tech's bioengineering center. The technique he and his colleagues are working on combines the flat images and adds color, so that the task of visualizing three dimensions shifts from the physician's mind to the computer screen. The approach uses a Pixar computer originally devised for special effects in George Lucas's films.

NUCLEAR UN-NEWS

When NBC News aired its documentary "Nuclear Power—In France, It Works" last year, Fairness and Accuracy in Reporting (FAIR) said the network should have told viewers at the outset about the investment of General Electric, the network's corporate parent, in nuclear power. No evidence existed that GE actively influenced the documentary, FAIR noted, but a month after the broadcast—and after the organization's initial complaint—NBC News failed to report accidents at two French nuclear installations that injured seven workers.

Recently, according to *Extra!*, FAIR's newsletter, "the story took on a new glow when NBC's nuclear special won first prize for science journalism in a competition sponsored by the Westinghouse Foundation." *Extra!* points to the foundation's affiliation with Westinghouse Electric Co., which it says "is one of America's leading investors in nuclear power."

ILLUSTRATIONS: JON McINTOSH

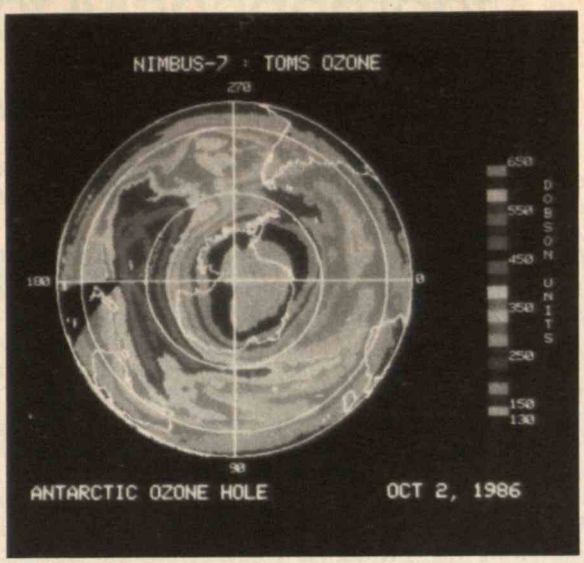


ROADSIDE FABRIC

By weaving a web of synthetic fibers, a French company has created a material that can replace concrete in road embankments. Called Texsol, the web is cheaper to use than concrete. First produced in 1978, it was applied experimentally in 1982 to repair a collapsed embankment. Since then, over 40,000 square yards have been installed.

Texsol can hold up embankments on extremely steep slopes, making it possible to widen roads cut through narrow spaces. Moreover, the material can absorb some shocks caused by earthquakes and vibrations.

Saving the Earth's Ozone



The Antarctic ozone hole, shown in violet, has grown annually since 1979. A new treaty aims to slow the process.

Last September, the United States and 23 other countries decided to protect the earth's ozone layer, which blocks most of the sun's ultraviolet rays. With the signing of the Montreal Protocol, the nations vowed to reduce emissions of chlorofluorocarbons (CFCs) and their less-known chemical cousins, halons. Seven more countries have signed on since then, including the Soviet Union.

The ink on the treaty was barely dry when an Antarctic expedition brought the news that the "ozone hole" was larger than ever. Thus, Sherwood Rowland, the chemist from the University of California at Irvine who first suggested the CFC threat, believes the accord will set a precedent, and CFC use will decline even faster than the protocol mandates. "People are scared to death. The damage is sufficient enough and is going fast enough that people are going to push beyond this," he thinks.

CFCs have contributed a lot since General Motors chemists created the first ones 60 years ago. They've cooled houses and cars, kept fast food hot, and cleaned sensitive electronic components. But in 1974 Rowland and postdoctoral associate Mario Molina warned that these compounds might be destroying ozone in the stratosphere.

The protocol is intended to drastically reduce CFC production. Developed countries must roll back use to 1986 levels almost immediately and halve it before the year 2000. Although halons destroy ozone more efficiently than CFCs, their use is only capped, because applications are limited mainly to fire extinguishers.

The treaty goes into effect New Year's Day if 11 countries representing two-thirds of global CFC consumption ratify it. Mexico was the first to do so, and the U.S. Senate followed suit in March. As many as 28 other countries could ratify in 1988, easily satisfying the requirements.

The protocol contains several exemptions intended to meet the needs of different countries. In the few developing countries to sign the document, business as usual has been allowed to continue until 1999. Because of this grace period, economic growth tied to refrigeration and other CFC-dependent technologies won't be stymied during the search for substitutes.

A second exemption lets developed nations proceed with CFC production in plants under construction or already contracted for. Thus, the Soviet Union can increase its consumption almost 70 percent. This clause was added to accommodate long-term Soviet plans.

Strengthening the Protocol

Several unknowns—especially who the signatories will be—make it difficult to predict the treaty's impact. According to the U.S. Office of Technology Assessment (OTA), global CFC consumption would drop 40 to 45 percent by 2009 if the whole world followed the protocol. With no treaty, CFC use would more than double.

Unfortunately, many nations are holding back. China, India, and South Korea have the potential for major increases in CFC consumption, and without these and several other key nations on board, the OTA estimates that CFC levels would fall only 15 to 30 percent. David Wirth, a senior attorney for the Natural Resources Defense Council, adds that even with the treaty, 2 percent of global ozone will be lost by 2050.

Wirth calls the protocol "a good first cut," but says his organization would like talks to be reopened as soon as possible. "The science that was relied on by the protocol negotiators is now out of date," he believes.

Indeed, after its October hearings to consider the data from the latest Antarctic ex-

PHOTOS: NASA

pedition, the Senate Environment and Public Works Committee asked the Egyptian scientist Mostafa Tolba—head of the U.N. Environment Programme, which sponsored the Montreal negotiations—to call emergency meetings.

Barring emergency meetings, the first scheduled conference to examine the protocol's impact is set for 1990. One issue that may be resolved then is whether developing countries can export goods made with CFCs. If not, South Korea—and some other nations—may not join. South Korea uses CFCs to clean computer chips and to make upholstery, dashboards, and air conditioners for Hyundais. Buying CFCs from countries that don't adopt the protocol is taboo, but the guidelines for buying products manufactured with CFCs or containing them have yet to be established.

Another issue to be addressed is handling violators. According to Rowland, there is still money to be made in the restructured CFC industry, and entrepreneurs don't appear discouraged. He says that during his recent trip to South America, Argentinians talked about building plants with German and Japanese money. Germany and Japan have signed the treaty, but Argentina hasn't.

Ironically, U.S. CFC manufacturers could become unofficial watchdogs, says Kevin Fay, who is executive director of the Alliance for Responsible CFC Policy, a coalition of users and producers. "I don't think the major companies that are trying to do the good thing are going to sit idly by while others try to get around the rules," he points out. □

PATRICIA CLEARY is a Boston-based free-lance journalist.

Interactive Romance

Lips curving, his eyes rake over your inadequately dressed body, the damp chemise clinging to your legs and heaving bosom, your gleaming hair.

Contrary to expectations, that line and that inadequately dressed body do not appear between the covers of the latest Harlequin romance. The woman's kisses—as well as her duels with pirates, escape from crocodiles, and dances at an island ball—all take place in Plundered Hearts, a computer game released last fall by the Cambridge, Mass., firm Infocom.

Not only is Plundered Hearts the first computer game to imitate the literary genre of romance fiction, but it is probably the first in which the game player's role is female. Aboard the late-seventeenth-century ship *Lafond Deux,* the player/heroine voyages on the high seas in an attempt to arrive at the bedside of her ill father before he dies.

Written by programmer Amy Briggs, Plundered Hearts is also a rarity because the authors of computer adventure games are usually male. Infocom's five other game writers are men, and Briggs may be the only woman in the field. Over 95 percent of all players of computer adventure games are male; the largest proportion are teenage boys.

In issuing Plundered Hearts, "the point was to address a large part of the market that hadn't been addressed," according to Mike Dornbrook, Infocom's vice president of marketing. Briggs adds, "I felt its time had come."



Of course, aiming a product at a female market doesn't necessarily challenge the social order. "It's hip, it's clever, it's tongue-in-cheek. But it's not feminist," comments Janet Murray, principal research scientist in M.I.T.'s writing program. "Romance fiction is focused on the image of the powerful, violent male and the helpless maiden. It's obsessed with female virginity and male potency. Briggs observes all those conventions."

Before indulging her interest in computers, Briggs earned an English degree from Macalester College in Minnesota. She came to Massachusetts for a job test-playing games for Infocom, but soon realized that "writing a game would be a lot more fun than reading one." She auditioned by designing a small interactive-fiction game, as these games are sometimes called, and received Infocom's approval to compose a program based on the romance fiction that has held her attention since she was 14 years old.

However, Briggs found that to translate a romance-novel heroine into one in a computer game she had to beef up the character. Traditional romance fiction features a passive woman in an action-packed world of virile men. At first, Briggs considered making her heroine passive as well, waiting to be attacked, saved, wooed, and won. But she quickly concluded that a user forced into playing this passive role would be bored. "To make the character fun, you have to let her do things." Her heroine, guided by active verbs, kisses pirates, investigates rooms, climbs stairs, and opens or locks doors.

Ironically, in creating an atypically active heroine, Briggs ended up with an atypically passive hero named Falcon, the captain of the *Lafond Deux*. "I've had some people write that the hero is a wimp," Briggs comments. "I personally like to think of him as a sensitive wimp."

It will take more than an active heroine to convince doubters, though. At one point while reviewing the game, Murray tried to command the heroine to use karate to stave off a nasty-intentioned pirate. "Karate is not part of my vocabulary," responded the computer. Murray jokes, "I don't want to play in a world where I can't kick a pirate using karate."

At another point, Murray instructed the heroine to jump into the sea and swim to safety. But the apparently sexist computer replied, "Swimming is not in the repertoire of well-bred young ladies." □

DENNIS GAFFNEY is a free-lance writer based in Cambridge, Mass.

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ROBERT C. COWEN

The Rise of Eco-Diplomacy

NEARLY everyone knows about the drought that has ravished North Africa during the past decade, turning farmland into desert and causing famine and death. But most people are surprised to learn that some of the best climate research on that region is conducted by the U.S. Central Intelligence Agency.

The reason is that environmental disasters can have direct political consequences. For example, the African drought has shrunk Egypt's water supply to the point where ecological pressures could threaten the stability of the government and the peace of the region. Egypt receives more American aid than any other country in the world, with the exception of Israel. U.S. diplomats may have to consider the possibility that ecological aid will become a political necessity for Egypt in the years to come.

CIA climatological research is only one example of a much larger trend. Environmental problems are becoming a dominant item on the international political agenda of the 1990s. In fact, we may be entering a new era where East-West ideological conflicts are overshadowed by cooperative efforts to prepare and protect the global environment.

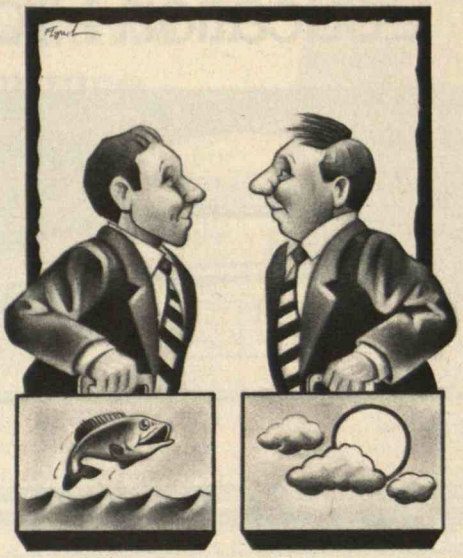
Only International Solutions

Not all environmental problems involve the possible fall of governments. Many are receiving growing international attention because they can be addressed only by international political agreements.

The treaty to help protect the stratospheric ozone layer may be the trend setter. (*See "Saving the Earth's Ozone," page 15.*) According to the provisions of the agreement, participating nations must freeze CFC consumption at 1986 levels by July 1990 and reduce that consumption by half within a decade. This won't fully eliminate the chemical threat to the ozone layer. Nevertheless, the treaty represents something more than a mere goodwill gesture by the signatory nations. It will involve real economic costs, costs the signatories are willing to absorb out of concerned self-interest in maintaining the long-term livability of our planet. This is a major step forward from the recent past when environmental concerns were often dismissed as a dispensable luxury only the wealthiest nations could afford.



ROBERT C. COWEN IS SCIENCE EDITOR OF THE CHRISTIAN SCIENCE MONITOR *AND FORMER PRESIDENT OF THE NATIONAL ASSOCIATION OF SCIENCE WRITERS.*



Pressing environmental problems with broad international implications are spawning new kinds of global action.

What other such environmental issues might push their way onto the international stage during the next decade? Other changes in atmospheric chemistry—above and beyond the threat of CFC to the ozone layer—are likely to command attention. Methane concentration, for example, continues to rise worldwide at about 1 percent per year. According to Donald Blake and F. Sherwood Roland of the University of California at Irvine, the average global methane concentration of 1.69 parts per million is 11 percent higher today than it was a decade ago.

Methane is produced by bacteria in swamps, rice paddies, and the intestines of cattle. Its rising concentration appears to be largely a by-product of human activity, especially intensified agriculture. Increased methane production is a potential environmental danger because methane is a "greenhouse" gas. Like carbon dioxide (CO_2) released by burning oil and coal, it traps outgoing heat radiation and warms the planet. If methane continues to accumulate at its present rate, its potential to warm the planet will soon rival that of CO_2 itself.

Methane also contributes to complex chemical reactions in the stratosphere that deposit water in that dry atmospheric region. Rowland and Blake estimate there is as much as 28 percent more water in the stratosphere today than during the 1940s and 45 percent more than two centuries ago. They speculate that this could aid the formation of stratospheric clouds over Antarctica, which are believed to provide sites for chemical reactions that encourage the sharp springtime drop in ozone concentration known as the Antarctic ozone hole.

If increased methane production becomes a major concern for its effect on climate, just like CO_2, then nations may begin to feel pressure to work out global energy-use and development strategies that will minimize release of such gases.

Ecology and Development

Curbing excessive deforestation probably is another area where nations will soon be driven to find ways to reduce damage. Forest loss, especially in the tropics, means the tragic destruction of species and contributes directly to massive soil erosion. This latter effect is one of the factors that led the World Bank to add environmental considerations to the criteria on which it bases its decisions about development loans.

This new policy demonstrates that at least one important player on the world development scene now recognizes that environmental concerns cannot be ignored. In the decade to come, it is likely that international environmental issues will receive even more serious political—as well as scientific—attention. Indeed, perhaps a new type of professional will emerge in the 1990s—the eco-diplomat. □

ILLUSTRATION: FRED LYNCH

A new cabin control system for Boeing's 747-400 jumbo jetliner uses all-digital technology to perform a wide range of passenger service functions previously unavailable. The Advanced Cabin Entertainment and Service System (ACESS), designated the APAX-140, extends the application of digital multiplexed techniques to such functions as cabin interphone, lighting, and advisory signs. Other features include an interactive, two-way capability that allows passengers to communicate back to a central computer for in-flight ordering of specific goods and services, and a self-test function that monitors and records faults while in flight. Hughes Aircraft Company, supplying multiplexed passenger entertainment and service systems since 1970, designed and built ACESS for Boeing.

A new advanced launch system (ALS) design for the U.S. Air Force will use off-the-shelf engines combined with modular configurations to reduce current launch costs. Hughes' ALS design will use a modified version of the Pratt & Whitney RL-10 liquid hydrogen/liquid oxygen rocket engine, with different numbers of modules tied together, depending on payload weight. The Department of Defense and NASA will require payloads ranging from 40,000–250,000 pounds to be placed in low Earth orbit. Aiding in cost reduction, the new design also features recovery of much of the booster. Hughes expects to meet the requirements for the ALS with its modular design by the mid-1990s.

A new software development tool significantly reduced fault locating time for the Hughes APG-70 radar aboard U.S. Air Force F-15E dual role fighters. Unlike previous systems requiring software check-out after the completion of hardware, the Hughes Digital Software Integration Station (DSIS) can test and de-bug software while the hardware is being built, resulting in substantial development cost and schedule savings. Further economies result from the radar's built-in test capability. It has ten times the software and six times as many test targets as its predecessor, the APG-63 radar. The APG-70's increased reliability and maintainability are expected to triple the time between unit replacements.

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A broad spectrum of technologies, many of which grew up within the past five years, are represented in the products of Hughes' Industrial Electronics Group. Six divisions and two subsidiaries, each operated like a small high-tech company but backed by resources of its multibillion-dollar parent, offer career benefits to qualified engineers and scientists. Advancing technologies such as microwave and millimeter-wave communications, silicon and GaAs solid-state circuitry, fiber optics, and image processing equipment are pursued in facilities located in many of Southern California's most desirable coastal communities. Send your resume to A.T. Moyer, Hughes Industrial Electronics Group, Dept. S2, P.O. Box 2999, Torrance, CA 90509. Equal opportunity employer. U.S. citizenship required.

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LESTER C. THUROW

Window of Opportunity

THE fall of the dollar presents American industry with a five-year window of opportunity. If firms take advantage of it, they could regain domestic and international markets lost to foreign competitors in recent years. If they don't, then foreign firms will be in a position to permanently defend and ultimately expand their current market shares—at the expense of American industry's long-term economic health.

The key to this window of opportunity is the cost of U.S. labor. When the dollar was strong, U.S. firms employed some of the highest-paid workers in the industrial world. The current low value of the dollar, however, has pushed American wages below those in most developed nations, giving U.S. firms a significant wage advantage over many foreign competitors. The expected continuing decline of the dollar will only strengthen this advantage.

Making the Most of Low Labor Costs

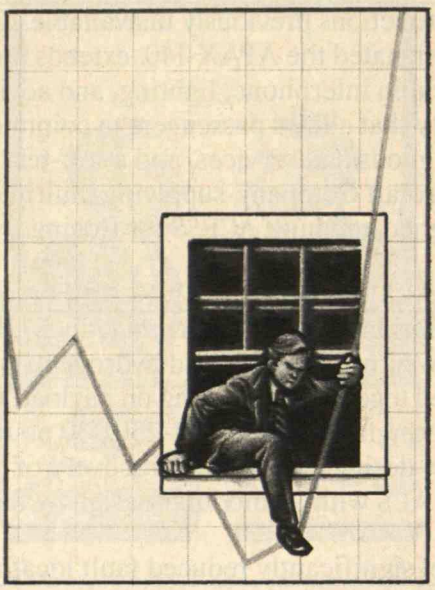
Lower labor costs allow firms to cut prices significantly and regain market share. They also give businesses a chance to improve quality, productivity, and technology, which is crucial to lower production costs in the long term.

However, there is a catch. This window of opportunity is open for only a brief period. Foreign firms know that American wages are now lower than their own. So to protect their American markets and to defend their markets at home, they must invest in off-shore production facilities in the U.S. But building or buying the necessary capacity takes time, and until then, foreign firms will have to compete with higher costs.

What's more, foreign companies are not apt to build production bases here unless they have a significant U.S. market share. The start-up costs are simply too high and the uncertainties too great. Thus, American firms must dislodge foreign companies from their entrenched position in the U.S. market as quickly as possible. And the only way is through aggressive price cutting.



ECONOMIST LESTER C. THUROW IS DEAN OF THE SLOAN SCHOOL OF MANAGEMENT AT M.I.T.



The declining dollar offers U.S. businesses a chance to compete—if they have the courage to take it.

But price cutting alone is not enough. While foreign firms have a cost disadvantage today, they often have an offsetting advantage of better quality and productivity. Too often American firms have become mere followers when it comes to introducing new process technologies or management techniques such as just-in-time inventory control. Such methods often result in greater productivity. But even more important, they allow firms to achieve a level of quality not possible with traditional technologies and procedures.

Put bluntly, American firms must go beyond simple cost cutting to become competitive, and dedicate themselves to enhancing quality. This is precisely the strategy that has allowed foreign firms to defend their market shares successfully despite their higher costs. To reduce those shares, American companies must rapidly raise their quality and productivity to world-class levels.

The Seductive Choice

Both short-term price cuts and long-term productivity and quality improvements depend on something more—a sense of self-restraint and a long view of economic survival. As the price of competing imports rises, American firms will face a seductive choice. They can regain market share and prevent foreigners from establishing American production facilities by holding their prices down as import prices rise. Or they can make a lot of short-term profits by letting their prices rise along with those of imports—but at the cost of allowing foreign production facilities to become well established in the U. S.

American firms will be tempted to forget the future and make high short-run profits. But resisting that temptation will be central to long-run success.

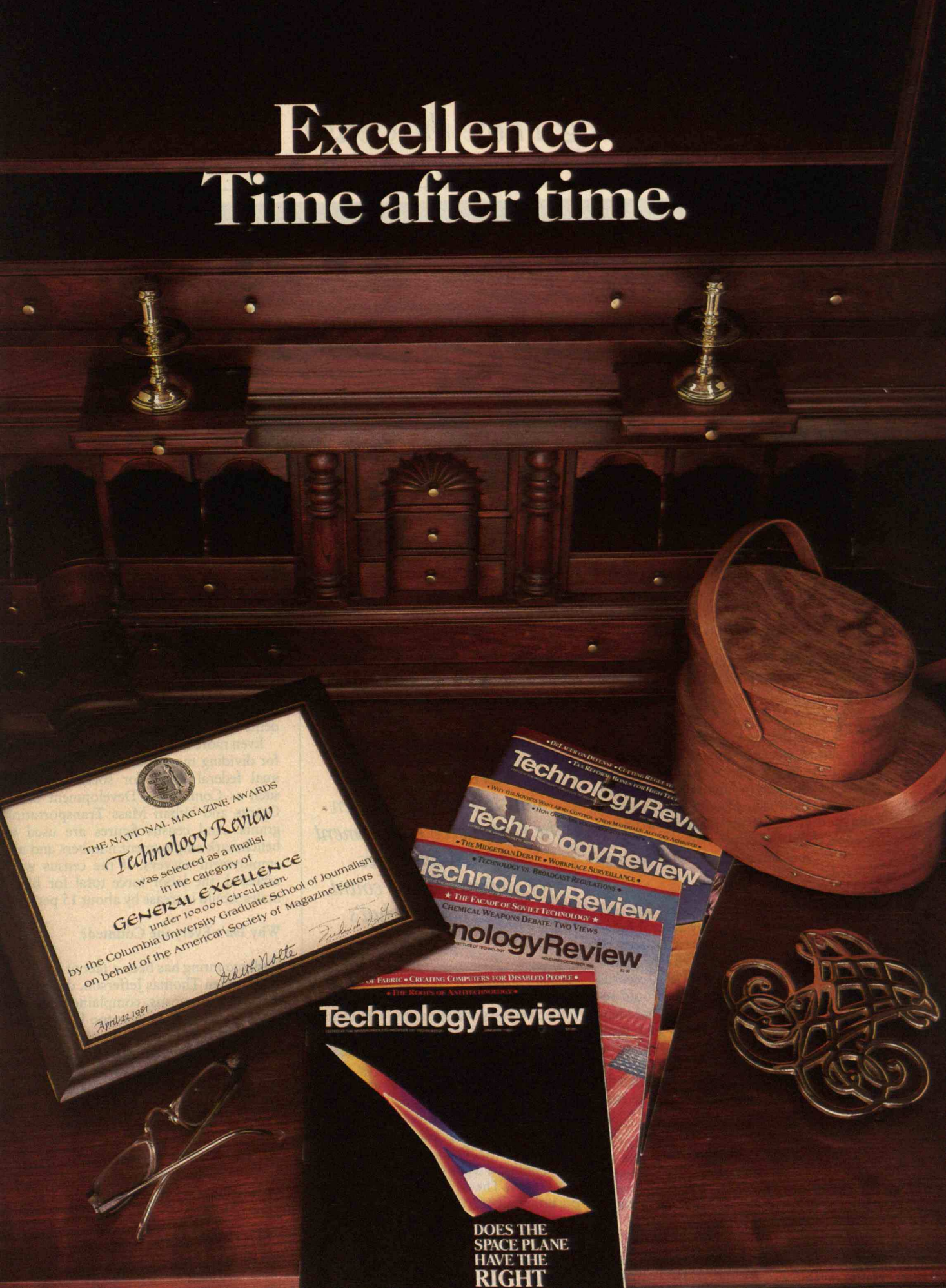
In recent years, U.S. industry has often been accused of an addiction to short-term results. That accusation is about to be put to the test. If true, five years from now American firms will find themselves increasingly squeezed out of their home market by foreign competitors who are making their products with those same low-cost American workers. Looking back, profits will have been extraordinary; looking ahead, profits will be vanishing.

A key player in resisting the temptation for short-term profits will be the American financial community. If investors cannot or will not distinguish between low profits caused by an aggressive strategy for recouping market share and low profits caused by bad management, then firm managers are going to find it extremely difficult to take advantage of the current situation. This suggests that any successful price-cutting strategy will have to be accompanied by a systematic campaign to persuade the financial community that such action is essential to the survival of both U.S.-based industries and the financial firms that service them.

The only path to renewed economic competitiveness is aggressive price competition. The only way to sustain that competitivess over time is through improved quality and productivity. Both will require a strong dose of social discipline and self-restraint. Neither is certain to occur. □

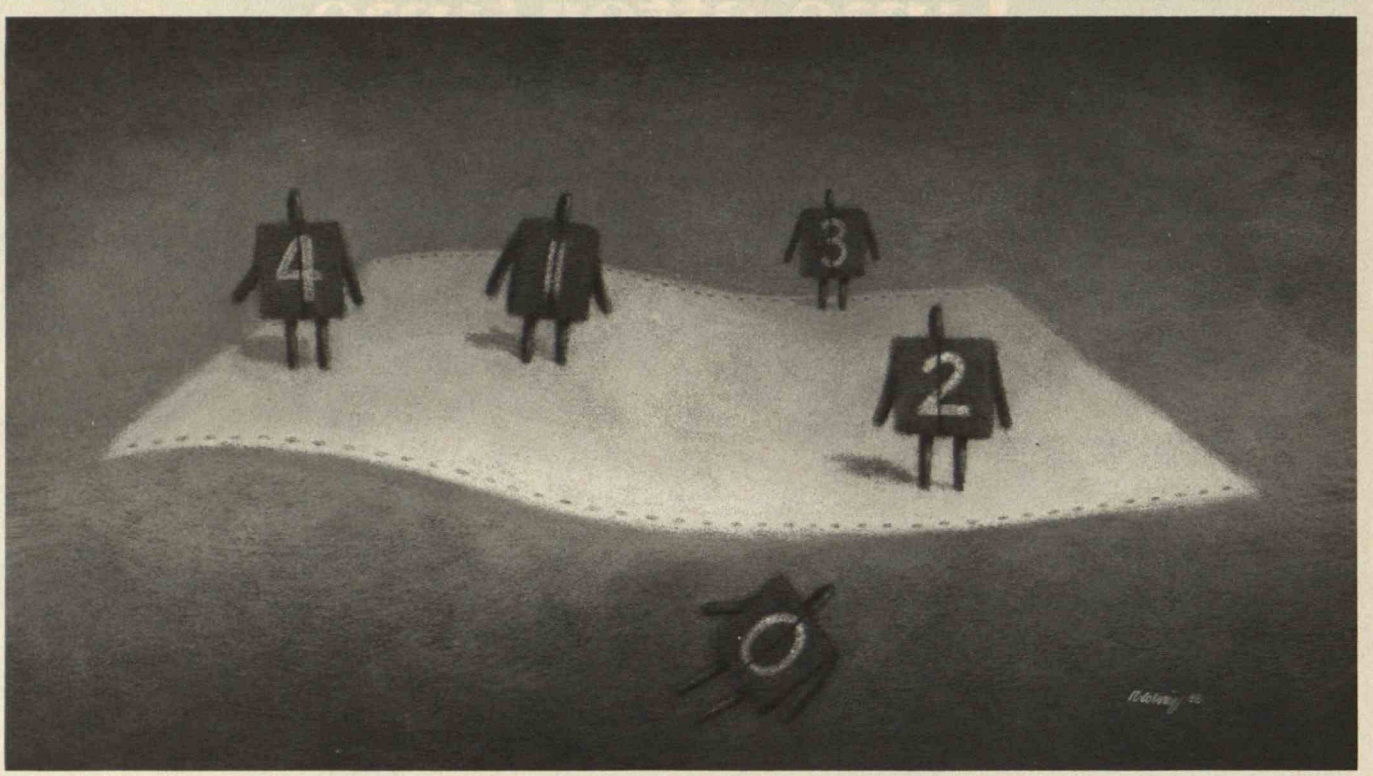
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BY BARBARA A. BAILAR

Finding Those the Census Missed



The Census Bureau's head of statistics resigned when the Commerce Department rejected measures for improving the count. She explains what's needed.

AFTER the 1980 census, the U.S. Census Bureau was hit with 38 lawsuits from angry communities and states. Because the 1970s had witnessed the use of census data to allot billions of dollars in annual federal aid, politicians throughout the country charged that sophisticated statistical models should have been employed to account for millions of people who had been missed.

Although most of the suits were put on hold, one case filed by the state and city of New York was heard by federal judge John Sprizzo of the Southern District of New York. In December 1987 he found that an adjustment of the 1980 census might cause more error than it would remove, but testimony during the trial identified statistical improvements that were needed before the next census. Therefore, between 1981 and 1987 a Census Bureau team I headed up developed statistically sound methods to account for people census takers often miss.

BARBARA A. BAILAR, former associate director for statistical standards and methodology at the Census Bureau, resigned in January. She is the immediate past president of the American Statistical Association.

In October 1987, Robert Ortner, the undersecretary for economic affairs at the Department of Commerce, refused to accept our work. Among other things, he stated that adjustment would be controversial and probably would not improve the count.

While Ortner is correct about controversy, he is wrong about improvement. The Commerce Department's conclusion was a political decision, not based on technical work. The census determines the apportionment of federal and state legislative seats, and the kinds of people missed—the poor, minorities, and inner-city residents—don't vote Republican.

Even more important, the census is used for dividing more than $30 billion in annual federal funds for social programs such as Community Development Block Grants and Urban Mass Transportation grants. And census figures are used to benchmark employment numbers and unemployment surveys. If the census were adjusted, the labor force total for Black males would increase by about 15 percent.

Why Isn't Everyone Counted?

Undercounting has been a fact of life since 1790, when Thomas Jefferson, director of the first U.S. census, complained that the count of 3.9 million was too low.

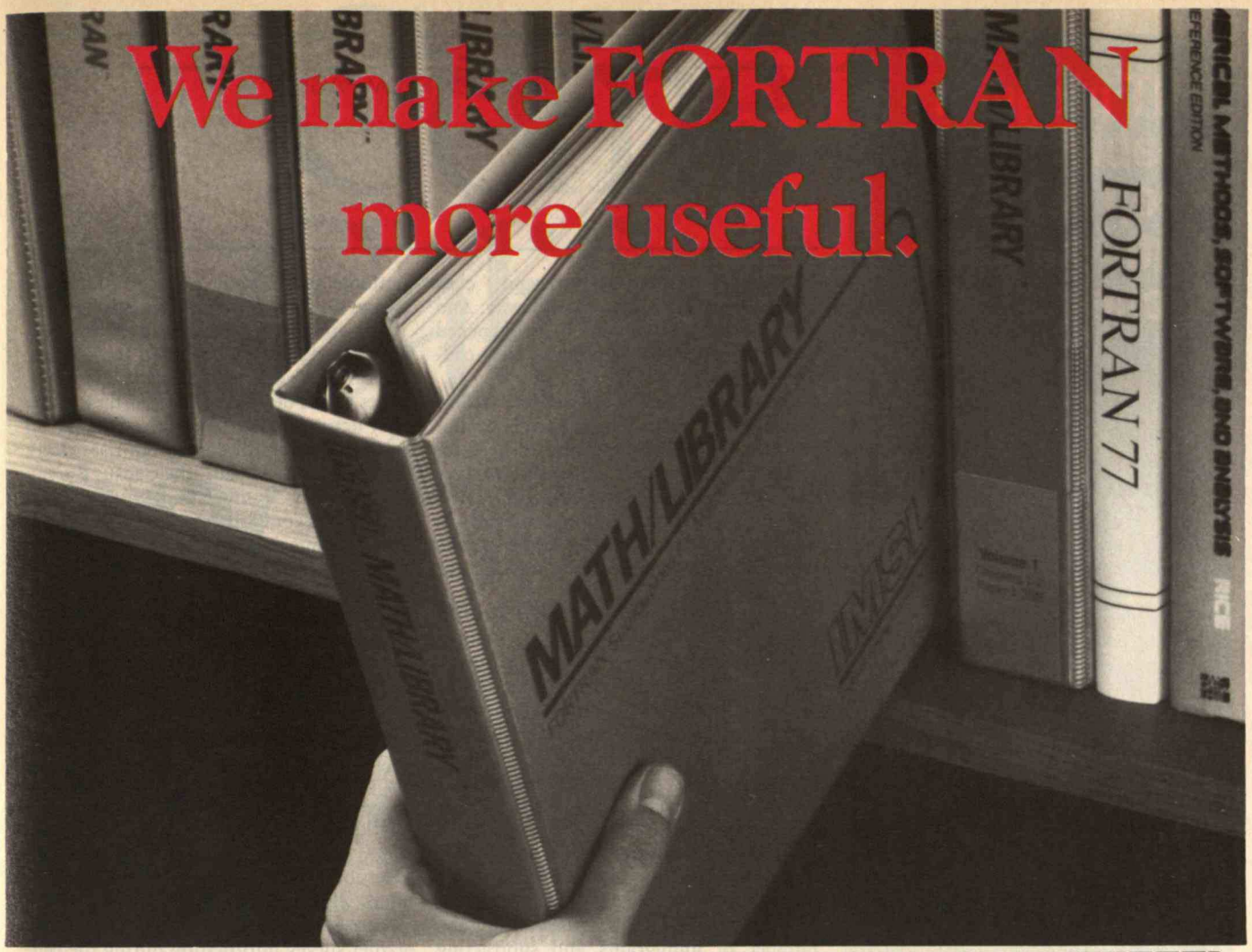
Standardized census procedures can produce misleading data for important segments of the population. What is the "usual residence" of a homeless person? What are the family relationships in some of the joint living arrangements that have become so common?

Many people fail to reveal their presence because of fear. Illegal aliens may not trust the bureau's pledge to keep census records secret from other government agencies.

Continued on page 24

ILLUSTRATION: ROB COLVIN

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CONTINUED FROM PAGE 22

Homeless families may not report children, scared they will be taken away. And many people who resent what's happened to them in society—such as runaway children—refuse to cooperate.

These problems are exacerbated by the fact that the Census Bureau usually cannot recruit enough census takers in hard-to-count areas. And not all census workers understand the rules for making certain decisions, or apply them consistently. In what community should an elderly person who owns a second home be counted, for instance?

The "undercount," which consisted of 1.4 percent of the population in 1980, is concentrated among young minority males in urban areas. The problem is most striking among Blacks, 5 percent of whom are not counted, compared with 1 percent of the Caucasian population.

If we don't count everybody, how do we know who's missing? Since the 1950s the Census Bureau has used two methods to measure the undercount. One method, called demographic analysis, consists of estimating the population by subtracting all deaths from all births, then adding the number of immigrants and subtracting emigrants. By comparing the total with the census count, we arrive at an estimate of the total national undercount.

The second method—the coverage-measurement survey—gives details about various groups. The survey, which is like a second census, is conducted in a limited number of the blocks into which the census has divided the country. The blocks are chosen randomly and are classified by urban or rural status, or by estimates of racial, ethnic, age, and gender groups. Because the survey is independent of the census, it can be expected to give different numbers. Combining the information from the survey and census in a statistical model produces better population estimates.

The survey would seem a reasonable tool for adjusting the census. But so far its results have not been as complete as necessary. For example, during the 1980 census, workers had only one week to collect information. If they didn't find people at home, they usually had no opportunity to return. By the time the bureau could revisit sites, census data were at least a year old and much information had changed.

The 1980 survey results also could not be applied at the state, city, and county level. For instance, the survey yielded a national undercount rate for Blacks. It makes no sense to apply that figure to different groups of Blacks in different areas.

Other techniques are used for altering the census, however. Census takers sometimes count one home twice if they know they have missed a family elsewhere. And when managers of some high-rises don't let census takers inside, the Census Bureau estimates the number and types of residents using computer models that consider similar units in the area. (Through this method Florida gained a congressional seat after the 1980 census.) These techniques give little information about people living on the streets or in hiding, though.

Refining Methods

The staff the Census Bureau set up to improve the measurement and adjustment process concentrated on improving the coverage-measurement survey. We worked with Harvard statisticians to develop state-of-the-art computer models that could ascribe data for those housing units where no one was found. And we proposed giving workers three weeks to gather survey information during the census period.

This improved numbers considerably in a test census we carried out in 1986 in East Los Angeles. A survey of areas where the census showed solid blocks of single-family housing indicated that garages and recreational vehicles in backyards had been turned into more housing. Sometimes the survey found three or four families where only one had been reported in the census.

In addition, we helped make the survey results applicable to states, cities, and most counties. This required determining the real differences in the undercount rates of various populations. The improved survey could show how undercount rates differ between Blacks living in rented housing in an inner city and Blacks living in their own homes in a suburb.

We concluded that adjustment was technically feasible, and that it would improve the census counts. A National Academy of Sciences panel, which we had asked to review the refined techniques, agreed.

In refusing to accept our adjustments for the 1990 census, Commerce Department officials decided that the 1990 census's $2.6 billion budget would not include the $30 million needed for a coverage-mea-

Continued on page 70

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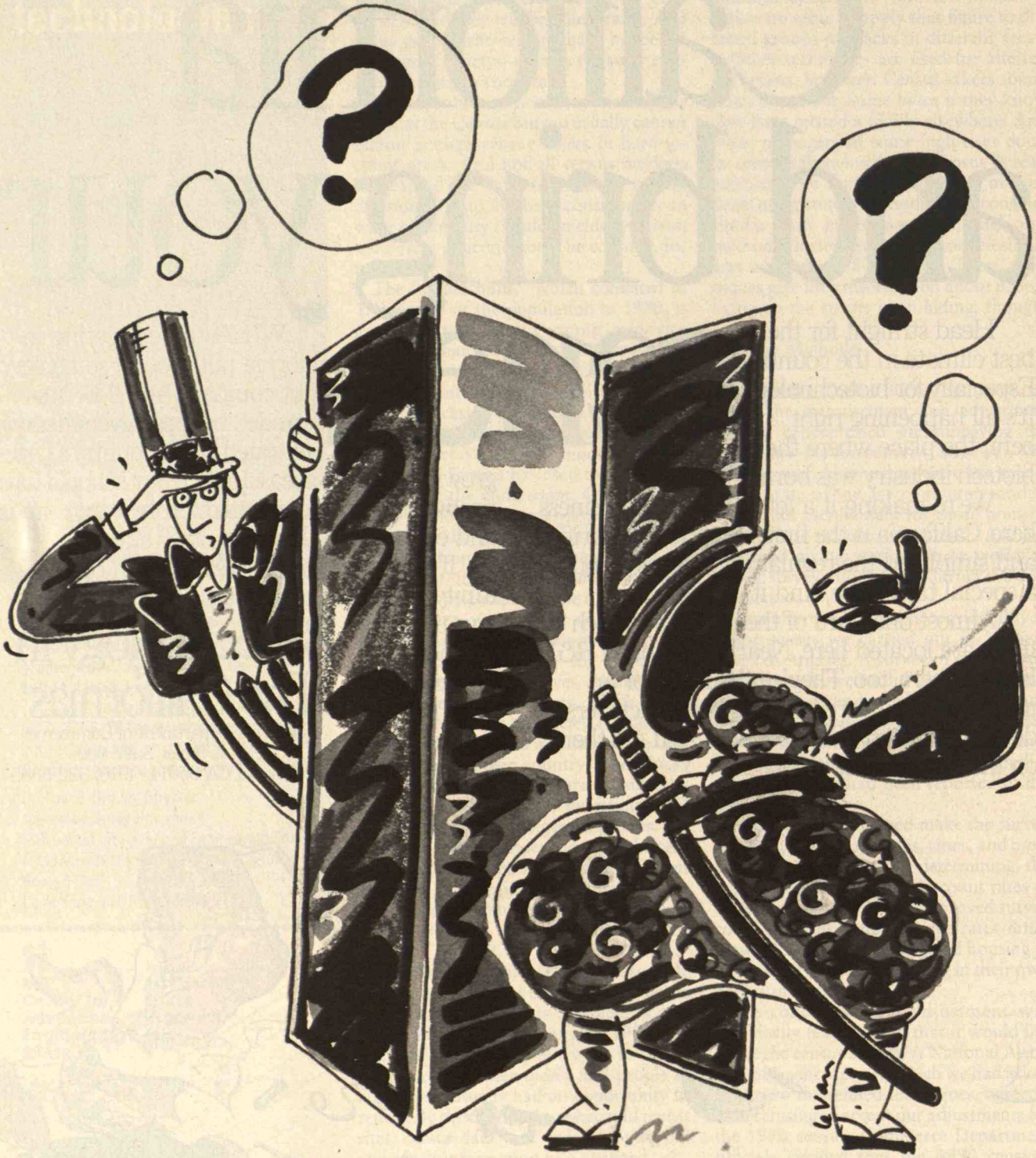
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BY CLYDE PRESTOWITZ

Japanese vs. Western Economics

WHY EACH SIDE IS A MYSTERY TO THE OTHER

Japan owes much of its extraordinary industrial strength to a philosophy that contradicts the free-trade system and that few Americans understand.

UNDER great pressure from the United States as a result of rising trade frictions, in 1981 Nippon Telegraph and Telephone (NTT), the Japanese telecommunications company, agreed to open its annual procurement of $6 billion to foreign bidders. However, NTT's chairman at the time maintained that the only thing his company could buy from foreign firms would be buckets, mops, and telephone poles. Indeed, in the next two years, the firm purchased only about $30 million of U.S. goods, mostly in the bucket-and-mop category. In 1983, again under pressure from the United States, NTT finally decided to buy something significant from a U.S. manufacturer. Thus, on July 23 a delegation from the company arrived at Hughes Aerospace Corp. in El Segundo, Calif. Its stated mission was to buy software.

The Japanese and U.S. accounts of this meeting differ as night and day. As counselor to Secretary of Commerce Malcolm Baldrige, I received an irate telephone call from a Hughes executive that evening. Did I know, he asked, that the Japanese group, which the U.S. government had encouraged him to receive, was trying to obtain the technology for constructing its own telecommunications satellite? No, I responded, I understood they were looking for software. "Well," said the executive, "they described the software and it essentially involves teaching them how to build a satellite." Furthermore, he said, "We know they're in the market for a satellite, and when we asked if we could bid, they told us that they couldn't buy an American satellite because it is Japanese government policy to develop one of their own."

NTT later expressed surprise at Hughes's reaction, maintaining that it was interested only in software that would make satellites work better.

Whatever the truth of the situation, the subsequent facts are not in doubt. News of the meeting sent a shock wave though Washington. The U.S. government immediately asked the Japanese government to explain its policy. If, in fact, NTT could not buy a satellite, all the praise the government had earlier heaped on Japan for opening its telecommunications market would be shown to have been misplaced. More important, the incident

ILLUSTRATIONS: SUSAN LEVAN

would support the belief of many Americans that Japan's important markets remain closed because its leaders target certain industries for development.

After several months of crashing silence, the Japanese finally admitted that they did have an "infant industry" policy aimed at promoting indigenous satellite production. Long, hard negotiations ensued, at the end of which Japan agreed to buy two U.S. satellites. But the most interesting aspect of the talks was that despite the obvious contradiction with free-trade doctrine, Japan did not abandon its infant-industry policy. All government users of satellites had to continue to buy Japanese, and other users were directed to "consider the national interest" in their purchases.

These events exemplify some of the strategies that the Japanese have used to gain a foothold in many key industries. The basis of these strategies was spelled out in 1983, when MITI officials told U.S. negotiators that in key technologies the government must intervene to make its firms competitive, thereby assuring the security of the country's economy. Nor are the Japanese policies limited to encouraging new industries. Companies beset by the problems common to mature industries are often directed to set certain production levels and to engage in joint buying, marketing, and stockpiling.

Many U.S. commentators deny the efficacy of these policies and argue that the Japanese simply do the things that create business success better than Americans or other Westerners. They point to Japan's high savings rates, well-educated labor force, and large population, and say that Japan would have achieved success with or without its industrial strategies. The fallacy of this view is evidenced by the fact that no Japanese hold it. As the economist Hiroya Ueno has noted, the Japanese government has always intervened to obtain a specific economic order viewed as favorable to the national interest. Few Americans understand these wide-ranging efforts or how directly they contradict Western economic doctrine and expose its weaknesses.

Western economic doctrine holds that consumption is the main purpose of economic activity. The demands of consumers are reflected in the unseen hand of the free market, which allocates resources most efficiently. Many firms, having no market power, compete on prices until they drop to a level that covers only costs. Internationally, the theory goes, nations should specialize in the goods they are best endowed to produce and trade for the rest. According to this doctrine of "comparative advantage," if a nation has a large unskilled labor force, for example, it should concentrate on making textiles or other labor-intensive goods. It should buy technologically advanced items such as airplanes from the United States, say, which has a resource base better-suited to making them.

The whole point of free trade is to enable an entrepreneur or a firm to exploit its particular capability worldwide. Free-trade doctrine says this is a benefit, not a threat, because it allows consumers everywhere to enjoy the fruits of efficiency and discovery. It is on this hallowed thinking that the international trade system rests.

The Japanese have difficulties with this theory. Since it assumes that a nation's products are determined by its resource endowment, the theory implies that national economic activity will remain relatively static. And because profits are driven down by extreme price competition, there is no return to invest in R&D. This means that advanced countries will always retain their position and formalizes a kind of colonial relationship with less developed nations. Indeed, based on the writings of the British economists Adam Smith and David Ricardo, the theory justified England's dominance of world trade during the Industrial Revolution.

Joseph Schumpeter, an Austrian economist and Harvard professor who wrote in the 1940s, formulated an alternative view of capitalist dynamics often ignored in the West. In his theory, what matters is not price competition or resource endowment but

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This article is adapted from Trading Places: How We Allowed Japan to Take the Lead, *by Clyde V. Prestowitz, Jr. Copyright © 1988 by Clyde Prestowitz. Reprinted by permission of Basic Books, Inc., Publishers, New York.*

In the United States the consumer is king; in Japan, the consumer comes last.



the competition arising from new technology, sources of supply, and industrial organization. An example of what Schumpeter meant is the Toyota just-in-time manufacturing system, which has led to a doubling and even tripling of productivity. The severe price competition of perfectly free markets may actually retard the R&D necessary for this kind of advance because a company will not have the profits to invest.

Schumpeter's concept of dynamic competition suggests that less industrialized nations can catch up, and that governments can legitimately intervene to make this happen. This is music to Japanese ears. As Naohiro Amaya, a former vice-minister of the Ministry of International Trade and Industry (MITI), indicated to me, "Businessmen are risk averse. Therefore, if the invisible hand cannot drive the enterprise to R&D, the visible hand must."

U.S. observers usually describe such an industrial policy as one of picking winners and losers, and most firmly believe that bureaucrats never do anything except pick losers. But the Japanese, aiming to attain as much autonomy as possible, attempt to foster development of as many industries as possible. According to Myohei Shinohara, a longtime member of Japan's Industrial Structure Council, it is especially desirable to encourage industries with high technology content, in which costs decline rapidly with increases in production. It is also important to promote industries that have ripple effects on other sectors. Semiconductors, for example, both have high technology content and are used in key products such as computers. These criteria seem simple and straightforward to the Japanese, whose bureaucrats do not feel that they rely on a mystical laying on of hands and do not claim any special clairvoyance.

All of Japan's domestic policies serve the goal of building its industrial strength. The education system provides an example. The Confucian tradition that Japan inherited from China emphasizes education, but technology never loomed large in this system. The thousands of engineers pouring out of Japanese universities today result from policies that deliberately encourage students to pursue engineering. This is borne out by the fact that Japan graduates relatively few chemists and physicists.

Japan's economic policies also serve its industrial policy. Japan maintains low interest rates for industry, but consumer loans, if available at all, usually carry high interest charges. Japan sets energy prices relatively high for consumers but keeps them low for industry. Everything is structured with one objective: to achieve industrial strength. This is the opposite of the U.S. approach where the consumer is king; in Japan, the consumer comes last.

Such an outlook accords well with the Samurai ethic of the Japanese, who cannot accept that their country will remain behind in any area of endeavor. It also reflects their view of economic health as national security. Since the time of Perry, the Japanese have seen foreign economic intrusion as a form of colonialism. Their dependence on the United States for defense makes them especially anxious to avoid economic domination. In lieu of a significant military establishment, an industrial policy aimed at achieving economic "security," by which they mean autonomy, has become Japan's strategy and its only assurance of some degree of independence on the international stage. Japan formulates its economic policies with an eye not only to their economic effect but also toward its overall power.

Japan puts these tenets into practice through an extraordinary domestic network that extends well beyond the efforts of the well-known MITI. Some of the main tools are the Industrial Structure Council, the Telecommunications Advisory Council, and other similar councils, which constantly study key industries and their relationships with others. These councils—which usually consist of members chosen from among leaders in business, consumer groups, labor unions, academia, government, and the press—issue a steady stream of white papers, often termed "visions," which form the basis for legislation for promoting or restructuring industries and encouraging R&D. MITI and other ministries also develop "elevation plans," which specify production levels for export, as well as R&D spending for specific projects from the visions. The elevation plans look much like the two- or three-year plans of major corporations and are in fact drawn up with industry representatives.

Many U.S. observers dismiss the plans as mere exhortation. But in Japan's group-oriented hierarchy, these procedures create a powerful consensus for achieving the objectives. The violent reaction to U.S. proposals in 1984 for placing Japanese nationals working for the Japanese subsidiaries of U.S. companies on the councils is strong evidence of their importance. Many Americans viewed as hyperbole the Japanese comparison of the Industrial Structure Council, which advises MITI, to the National Security Council. In fact, it was apt.

Japanese ministries have many tools at their disposal to achieve the goals established in the visions. They can set up companies such as the Japan Electronic Computer Corp., the government-backed leasing company established by MITI in the early 1960s to promote the Japanese computer industry in its battles with IBM. The Japan Electronic Computer Corp. provided immediate cash payments for computers manufactured by the financially strapped Japanese producers, and the company then leased the computers to customers.

MITI also often sets standards for industrial products that differ from those of other nations, automatically protecting the Japanese market from invasion by outsiders. And the Japan Development Bank makes low-interest loans to specific projects. Western economists often dismiss these loans as unimportant because they are usually just below the market rate, and because they fund only a small part of any R&D project. What outsiders do not realize is that by long tradition the loans are a signal to the financial community that it should give preference to targeted industries. The banks are willing to do so because the government backing reduces their risk. Companies can also draw up legal agreements to cooperate in cartels on deciding what goods to produce. Japanese machine-tool manufacturers have used such an agreement for the past 30 years to determine what sorts of machine tools each would make, as well as what direction the industry should take.

All these devices are important because they encourage investment and reduce risk. Even though Japan is a conformist, risk-averse society, it nevertheless produces business leaders lauded the world over for their long-term strategic thinking. The solution to the paradox is that the government socializes the risk, removing it from individual firms. In such circumstances, it is easy to be a long-term thinker.

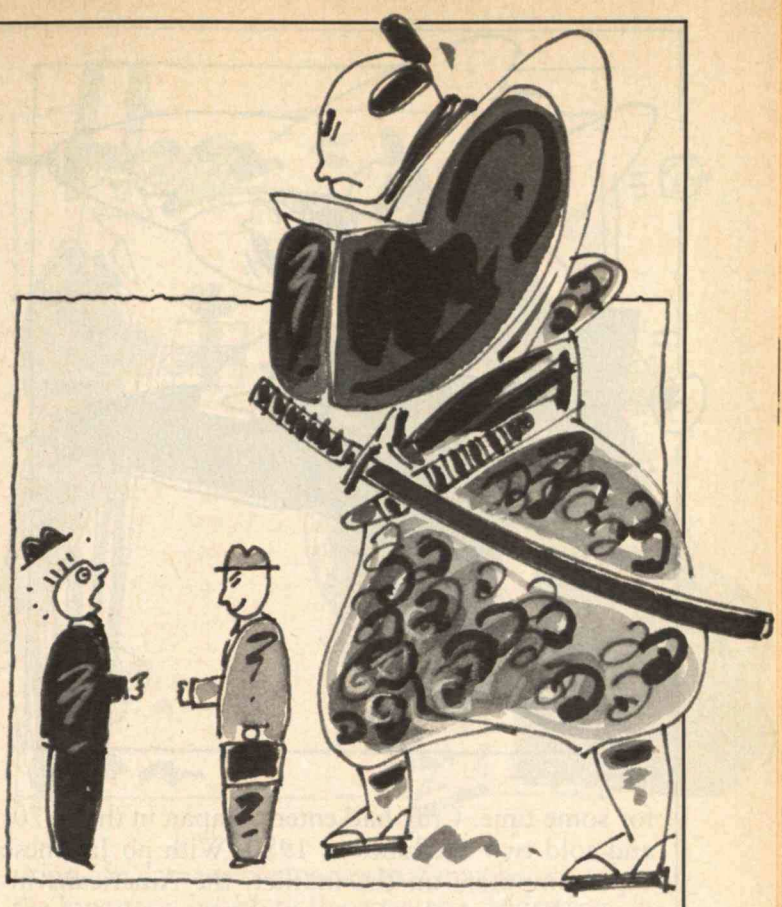
Gaining the Advantage in Fiber Optics

The fiber-optics industry provides an example of how the Japanese have used these tools to capture markets in which U.S. companies once had a clear advantage. Optical fiber was invented in the 1960s by Corning Glassworks using private funds. Corning obtained U.S. patents on its inventions in the mid-1970s. But Japan did not grant many of the key patents for more than 10 years, leaving Corning's technology unprotected in this major market.

When Corning attempted to sell its fiber and cable in Japan, NTT, the monopoly buyer, told the company that Japan would develop its own technology. NTT then launched a fiber-optic R&D project with three firms, each of which contributed to the costs. NTT agreed to pay a high price for the optical fibers they developed, and to make purchases in proportion to each company's share of R&D costs—a procedure similar to U.S. defense contracting. These measures reduced risk every step of the way.

At the same time, NTT suggested that Corning consider a joint venture with a Japanese company.

American officials were shocked to find the Japanese are intent on dominating the supercomputer market.



Corning invited Japanese representatives to its plants and laboratories and provided them with much useful information during dicussions of possible joint ventures. After long negotiations, Corning was informed that the Japanese company could not establish a joint venture because NTT would not buy from such an entity. With Corning thus locked out, the Japanese developed a process so similar to Corning's that the U.S. International Trade Commission, Canadian courts, and finally U.S. courts found that the American company's patents had been infringed. NTT meanwhile began buying optical fibers at inflated prices from the three Japanese companies.

The story does not end there. In 1980 to 1981, Siecor, a company producing cable from Corning's fibers, offered to sell its products to NTT after the latter had agreed to open its procurement to foreign bids. Siecor's cable performed better than that produced by Japanese companies and cost only one-third as much. But to submit a formal bid for supplying the cable, Siecor needed a copy of NTT's specifications. Only after months of haggling and pressure from the U.S. government did NTT provide this information. Meanwhile, procurement from Japanese manufacturers was expanding rapidly.

NTT insisted that Siecor not only meet its specifications but provide the same cable design as the Japanese manaufacturers. On its face this seemed a reasonable request, and Siecor was criticized for not trying hard enough. Yet some NTT executives later told me that the real problem was simply that NTT believed it had to support its own industry. The Japanese knew that Siecor's cost advantage was related to its design, and that Siecor would have to install an expensive new plant to change it. The U.S. firm did finally offer to build the plant if it was guaranteed a share of the market, as its competitors had been, but the Japanese denied the request as not being in accord with free trade.

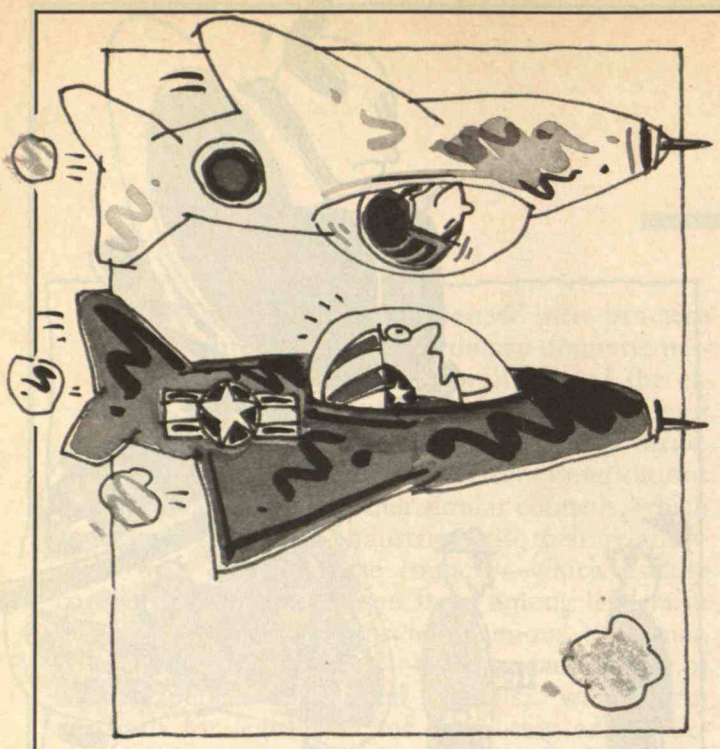
These maneuvers—as well as the designation of fiber optics as an industry of the future—enabled the Japanese firms to build enough capacity to fill their own market three times over. The companies then inevitably began the search for export markets—and, as always, the biggest was the United States. By 1983, Japanese manufacturers were selling optical fiber in the United States at prices well below the market. Corning brought suit in U.S. federal court and won in 1987, but by then its patents had almost expired.

This was promotion policy at work. While the Japanese government was reducing risk for its companies, the U.S. government was ignoring American firms, assuming that the free play of the market would allow the best to win. Japan became a powerful competitor, and U.S. observers congratulated it for its diligence and foresight while criticizing the rigidity of American business. Similar events have occurred in virtually every industry, from supercomputers to aircraft—the latter being two key areas where the Japanese now threaten the significant U.S. advantage.

The Japanese Build a Supercomputer Industry

Supercomputers flared into the headlines just a year ago, in the spring of 1987, when a secret cable from the U.S. embassy in Tokyo to the State Department was leaked to the press. The cable reported Makota Kuroda, a top MITI official, as saying that the United States might have to consider nationalizing Cray, the dominant player in the world supercomputer market, to save it from Japanese competition. The cable concluded in a shocked tone that Japan is intent upon dominating the industry.

U.S. officials should not have been surprised. Kuroda was only telling them what had been obvious



Japan has used its access to U.S. military technology to become a world-class aircraft builder.

for some time. Cray had entered Japan in the 1970s and sold two machines in 1980. With no Japanese supercomputers on the market, the Americans indisputably had the best and least expensive machines. In 1981, MITI announced a program to develop a supercomputer. From that time, Cray's prospective customers in Japan seemed to disappear. Government research institutes, a major market, told Cray it was a waste of time even to send representatives because the ministries that controlled their budgets would not allocate funds for foreign machines. Cray's sense of unfairness deepened when it learned that U.S. government laboratories, including Lawrence Livermore, were helping the Japanese companies with the design of their machines.

In response to U.S. inquiries, the Japanese government explained that its research institutes were too small to make use of such large machines. Two years later, however, when Japanese manufacturers finally introduced their products, many of the small institutes placed orders. Today, supercomputer sales in Japan are booming. Cray has managed to sell a few machines after enormous pressure from the U.S. government, but its share of the market remains small. Meanwhile, Japanese computer makers have already begun an export drive based on extremely low prices. In November 1987, M.I.T. canceled plans to buy a supercomputer from the Nippon Electric Co. at about one-third the normal price only after being warned of a possible antidumping investigation by the Commerce Department.

Battles over the Aircraft Industry

The Japanese are also moving vigorously into aviation—the one remaining area where the United States has a definite advantage. In 1981, the question of who would produce Japan's next generation jet fighter, the FSX, became a major trade issue. In the past, Japan's fighters had been versions of U.S. aircraft. At first, these planes had been made in the United States, but the Japanese had gradually insisted on building more and more under license from U.S. producers. Now strong forces in Japan were urging that it build the FSX entirely on its own, despite the fact that doing so would cost substantially more than buying from the United States or continuing with licensed production.

U.S. officials were dismayed. With the bilateral trade deficit approaching $60 billion, it seemed logical that Japan should buy its planes from the United States, which could build them for half the price of the Japanese producers. In the past, when Japan had insisted that it had to manufacture the planes in Japan, the United States had agreed to allow Japanese co-production of aircraft to assure the interoperability of the two nations' forces. The Americans had even relaxed the traditional ceiling on the percentage of the planes that the Japanese could build. Now, however, Japan was proposing to build a whole new plane itself in spite of the higher cost and the trade deficit.

In the end, under enormous pressure from the United States, Japan agreed to "jointly develop" a modified version of the F-16 with General Dynamics. But the fact that Japan chose to fight this battle at a time of bitter trade disputes with the United States is a measure of its dedication to self-development and autonomy. This has been confirmed by subsequent developments. The United States and Japan have recently been negotiating over the meaning of "joint development." The Japanese plans, as now revealed to the United States, seem to entail building the original FSX and calling it an F-16.

In fact, the Aircraft and Machinery Industries Council decided in the 1960s that Japan had to have a modern aircraft industry to be a technologically advanced nation. MITI promoted this goal by pledging $1 billion to $2 billion for a consortium of Japanese companies to become 25 percent equity

The United States seeks security by giving away technology while Japan hoards it.



partners in Boeing's new 757 jet liner. MITI also promoted development of industries in avionics, flight control, engines, and fuel systems.

Military co-production with the United States has made significant contributions to this technology base and Japan's emergence as a world-class aircraft builder. Some U.S. military personnel have been leery of this information transfer: after concluding the co-production agreement on the F-15, air force specialists drew up a detailed list of technologies considered too sensitive to give Japan because of the danger that they would fall into Soviet hands. Yet when Japanese officials indignantly confronted U.S. officials with the list, arguing that it would be too difficult to make repairs, the department released much of the technology.

Japan was especially adamant about obtaining the technology for making the carbon composites that compose the speed brake of the F-15. The air force strongly opposed this transfer but was overriden by the secretary of defense. By 1981 Japan could reproduce the technology, and Japanese executives later acknowledged that it had been valuable in several key commercial projects.

U.S. officials, in contrast, have been frustrated in trying to transfer Japanese "dual-use" technology—used for both military and commercial products—to U.S. defense manufacturers. Years of negotiation produced an agreement in 1983 that Japan would permit such transfers. However, virtually no technology has been forthcoming, despite Japan's dependence on the United States for defense. Thus, while the United States has sought security by giving away technology, Japan has sought it by hoarding technology, even from the United States. Ironically, the United States, Japan's defender, has now become its target.

Using Cartels to Restructure Industries

As mature Japanese industries begin to decline, the other major component of the nation's industrial policy—restructuring—comes into play. This is especially necessary since Japan's promotion policies tend to create excess production capacity, which can lead to severe price cutting and financial losses. The United States sees such price cutting as a boon to consumers, but Japan thinks that excessive competition can damage companies that may be critical for the long-term health of the economy. Moreover, Japan does not believe that the merger and acquisition activity so popular in the United States enhances productivity.

Japan has therefore developed an elaborate set of tools to restrain competition, including allowing companies to form cartels to jointly restrict production and capacity. An important characteristic of the cartels is that they reduce production in relation to each company's market share. This virtually guarantees market dominance in perpetuity to those who dominate at maturity. Companies thus tend to overinvest in an attempt to gain dominance. The risk is low even for the eventual losers because they know every effort will be made to keep them alive.

Moves to jointly reduce production require even greater cooperation between government and business than efforts to promote specific industries. The steel industry provides perhaps the best example of this policy. In 1977 MITI directed 52 electric-furnace steel producers to cut production by 35 percent or face a fine. They complied. Then in mid-1982, MITI issued a "guideline" to reduce steel production while raising prices, in an effort to restore profitability. Japan's Fair Trade Commission investigated from time to time but took no action.

The mechanics of the guidelines to the steel industry reveal the close coordination between industry and government. Every Monday at noon, black limousines swarm around the Iron and Steel Building

Japanese televisions and cameras cost more in Tokyo than in New York.

in Tokyo. From them emerge men from Japan's eight major steel companies. They go to room 704, where a sign reads "Regular Monday Club Meeting." The men take their places at a large, rectangular table, at whose head is the chief of MITI's Iron and Steel section. This group has met every Monday since 1958 to iron out a consensus on the MITI guideline for appropriate levels of investment and production. During this time, and even today, Japan's steel industry has been the world's most powerful.

To the rest of the world, Japan insists that it is winding down such depressed industries to make room for imports. Not surprisingly, in view of the wide-ranging MITI efforts at revitalization, the reverse has occurred. Frank Upham, an economist at New York University, found that of 14 officially depressed industries in Japan, only 2 saw increases in imports.

Even if imports in mature industries do rise, they tend to be under Japanese control. The aluminum-smelting industry provides an example. With the highest energy costs in the industrial world, Japan's smelting industry languished after the oil crises of the 1970s. MITI gave it preferential electric rates, special loans, and other aids. When in 1982 the world price was half that in Japan, both MITI and the industry, concluding that it could not be revived, set in motion a plan to move it to Indonesia and Brazil. Instead of simply allowing its companies to contract with foreign producers, the Japanese government consciously set out to ensure that half the domestic supply of aluminum would come from Japanese installations overseas, which were thought to be more reliable than those of other suppliers.

Japanese investment in the United States also reflects Japan's style of retaining as much control as possible in Japanese hands. For example, Toyota's new plant in Georgetown, Ky., is not being built by U.S. contractors, but by Ohbayashi Gumi Corp. Topy Industries, a supplier in Japan, plans to set up shop nearby to make wheels for the new factory. Hitachi, too, is building a plant in the area, and just down the road Trinity (Japanese also, despite the name) has set up an auto-painting facility. The Mitsui Bank is providing the financing.

U.S. observers such as the journalist Fletcher Knebel have noticed similar phenomena elsewhere. Living in Honolulu, Knebel observed that Japanese tourists arrive on Japan Airlines, take Japanese tour buses downtown to Japanese-owned hotels, and dine at Japanese-owned restaurants. In San Francisco, this practice is known as the "closed circle," and local travel agencies have brought suit on antitrust grounds.

Some analysts glibly say that the United States retains negotiating leverage in dealing with Japan because it needs the U.S. market. But America's debtor status makes its need for Japanese money much more powerful, and this need is already having portentous political effects. Indeed, Tennessee Governor Lamar Alexander told me in 1987 that he had been to Tokyo more often than to Washington during the past four years since "that's where we can get some real help." Kentucky Governor Martha Layne Collins remarked that during one of her trips to Japan, she met 14 other governors there as well.

Dealing with Resentful Partners

The result of Japan's policies has been one of the strongest sustained economic performances of all time—along with a rising tide of resentment from its trading partners. The Japanese have not been able to understand this and believe it is due to misperception. A major task of Japan's leaders is therefore to explain their industrial policies in a way that reconciles them with the free-trade system. Such explanations are difficult: having rejected the economic theories of the West, Japan nevertheless tries to show that its policies do not conflict with them.

MITI officials modestly maintain that their power to coerce private industry is limited. MITI, they say, simply studies industries carefully, writes reports, and makes forecasts. The officials liken these to the *U.S. Industrial Outlook*, an annual forecast of business activity published by the Commerce Department. They point out that the Japanese government supports only about 30 percent of Japan's total R&D budget, while the U.S. government supports over 50 percent of the American total. These officials neglect to mention that one reason for the large U.S. figure is a defense burden Japan does not bear.

MITI officials stress their belief that huge U.S. defense expenditures stimulate U.S. technological



development and enhance the competitive power of major companies such as IBM and Texas Instruments. They acknowledge that these programs are aimed at military, not commercial, development but say they still result in spin-offs. The Japanese clearly take for granted the necessity for governments to intervene to assure economic leadership.

American officials react with surprise to such statements. They understand the need to ward off threats to national security in the traditional military sense. But they are only beginning to grasp that Japan feels threatened if foreign countries move ahead in commercial areas.

The Japanese view of defense spending as an engine of technological progress is particularly significant. To the extent that the U.S. technological lead derives from defense spending, the Japanese government feels it must intervene to offset this effect. Thus, the supreme irony: the United States is spending partly to defend Japan, while Japan feels compelled to help its industry overcome the results.

Reconciling the Differences

Both the United States and Japan need to make significant changes. The Japanese policies are beginning to foster tremendous resentment worldwide. Other countries, as well as the United States, are tired of the fact that Japan only sells and never buys. Japanese officials looking at long-term security have to wonder about survival in such a world. They should create a foreign presence in their industries by promoting acquisition of Japanese firms by foreign investors and imports from foreign companies. Since Japan has maintained a distance from foreigners for the last 100 years, this won't happen naturally, and a version of affirmative action may be necessary.

Japan should also bear more of the cost of maintaining the free-world system. The United States spends some 8 percent of its GNP for this purpose, while the Japanese spend only 1 percent. They should reasonably be expected to attain European levels of 4 to 5 percent of GNP, or $100 to $150 billion a year. This could be used to support the U.S. military presence in the Pacific, provide debt relief for developing nations, and furnish international aid.

Internally, Japan needs to temper its self-sacrificing, non-consumerist orientation, which deprives its citizens of access to the fruits of their labor and deprives trading partners of the ability to sell to Japanese markets.

Several factors discourage consumption and increase prices—Japanese televisions, cameras, and other goods cost more in Tokyo than in New York. Laws protecting thousands of "mom and pop" shops severely limit the number of large retail outlets. This creates the need for a multi-tiered distribution system, which adds to the cost of everything. Moreover, major industrial groups such as Sumitomo and Mitsui—which have assets of some half a trillion dollars and sell everything from glass products to telecommunications satellites and real estate to semiconductors—exert enormous control over this distribution system. Consumer-credit interest rates are as high as 60 percent. The restrictions on large retail outlets should be loosened, major manufacturers' control over the system should be reduced by strictly enforcing antitrust laws, and consumer interest rates should be lowered.

Overly strict land-use regulations are another problem. To protect farmers, half of Japan's scarce land is reserved for agriculture, while the 94 percent of Japanese who are not farmers make do with the other half. Tight zoning restrictions impede office and apartment construction. As a result, Japan has both the world's highest food prices—rice sells at five to ten times the world price—and its highest land prices. A two-bedroom condominium an hour and a half by train from Tokyo costs nearly



When the U.S. concludes that free trade is unlikely, it should bargain for reciprocal deals.

$600,000, and apartments are so small that consumers have no place to put products they might buy. Japan should let agricultural land be sold for other purposes and revise building codes to allow construction of more houses and apartments.

However, the Japanese may not do everything the United States might like them to. Reducing land prices would require a shift of political power away from farmers. And even though there might seem to be a natural incentive to increase the size of dwellings and reduce the cost of products, the Japanese live better today than they did 10 years ago. Moreover, it is the United States that has the problem with remaining competitive. Thus, this nation needs to seek solutions that do not depend on Japan.

The United States must deal with its swollen budget deficit and boost its low savings rate if it hopes to provide industries with crucial investment capital. A cabinet-level entity that evaluates all forms of government investment, including those of the military, for their effect on the health of the U.S. economy would go a long way toward revitalizing the nation's industries.

Ventures such as Sematech, the government-industry effort to revitalize semiconductor production, are another important step. In a grudging 1987 editorial supporting Sematech as a lesser evil than protectionism, the *Washington Post* offered three excellent criteria for setting up such projects: the industry of concern should be crucial to the economy, it should be able to draw up its own research agenda, and it should contribute half the cost. It is clearly more important to encourage industries that contribute disproportionately to economic growth and productivity than, for example, the real-estate industry, which has been favored for years.

The United States must also realize that the primary basis for international trade—the General Agreement on Tariffs and Trade—is no longer adequate for doing business with Japan, if it ever was. The first step is to discard the belief that the Japanese market is like that of the United States, and that it can be made to operate similarly if only the Japanese will stop being unfair. In situations where the United States concludes that free trade is unlikely, it should bargain for specific conditions.

International airline negotiations provide a model. Most countries' airlines are regulated, and many are state-owned, since nations consider them a symbol of power. The United States knows that negotiating for free trade in this area would be useless, so instead it works out reciprocal deals. We give a certain number of flights a week to Japan, and they give us a similar number of flights in return. It is not an open market, but a great deal of competition occurs within a limited framework.

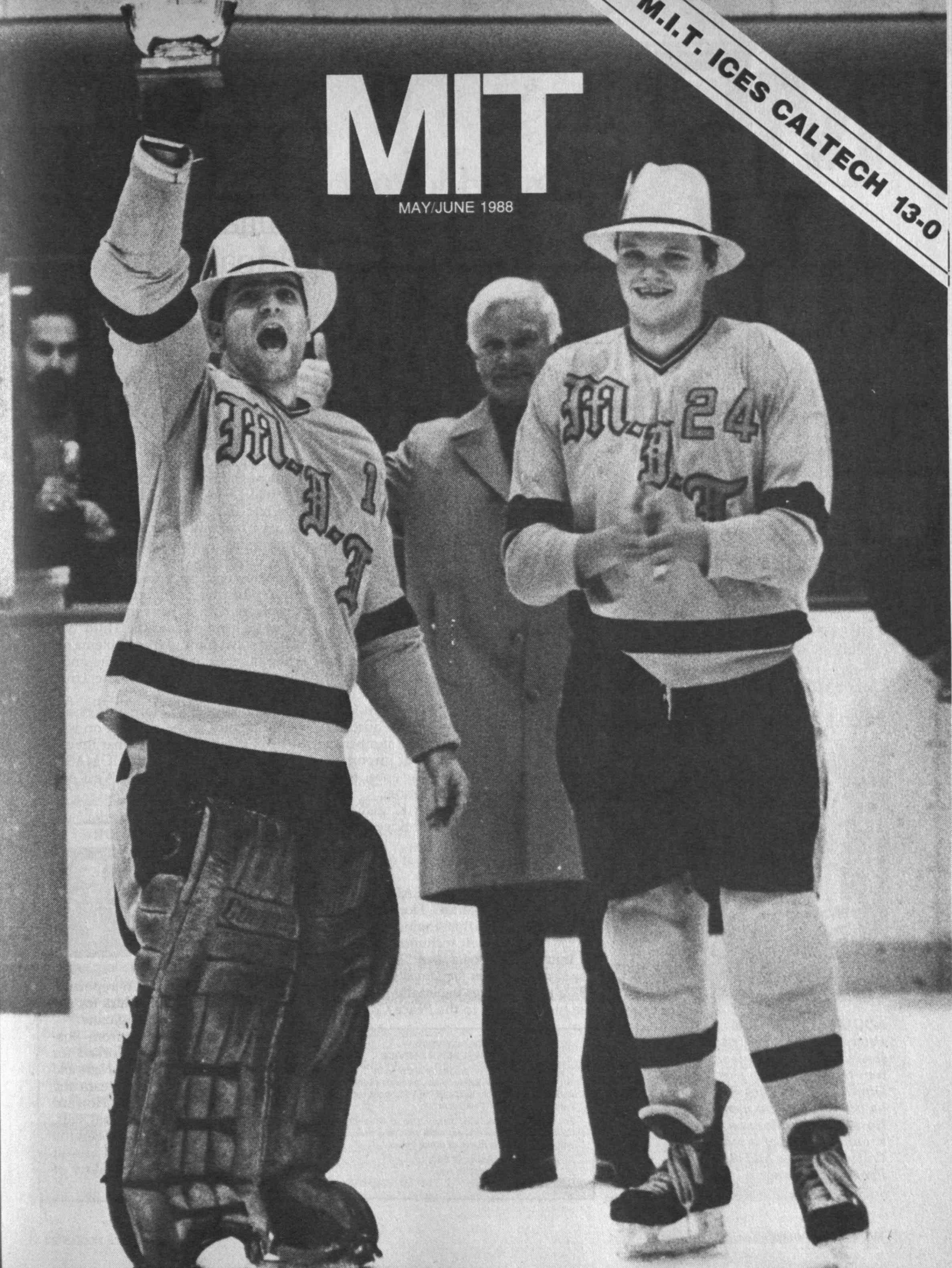
The United States has also been pressing for more open financial markets abroad as it has deregulated its own banking system over the past several years. But when Japanese and other countries' banks quickly gained major positions in the U.S. market, the U.S. Treasury did not call for free trade. Instead, recognizing that banking is a key industry, it persuaded foreign banks operating in the United States to increase their capital reserves to the levels required of U.S. banks. Imagine the outcry against protectionism had the United States demanded that Japan's semiconductor companies saddle themselves with the same cost of capital as the U.S. companies. But what is the difference? Only that Treasury thinks banking has a significance that semiconductors lack.

Even if the two societies do change, confrontation will undoubtedly continue. To avoid an increasingly rancorous relationship, the next president should convene a high-level conference of executive and legislative leaders from both Japan and the United States to create a new framework for mutual relations. The conference should deal not only with trade matters but also with guidelines for investment, the sharing of military and aid costs, and future political dealings. Only in this way can America's most important bilateral relationship be maintained in a healthy state. □

MIT

MAY/JUNE 1988

M.I.T. ICES CALTECH 13-0



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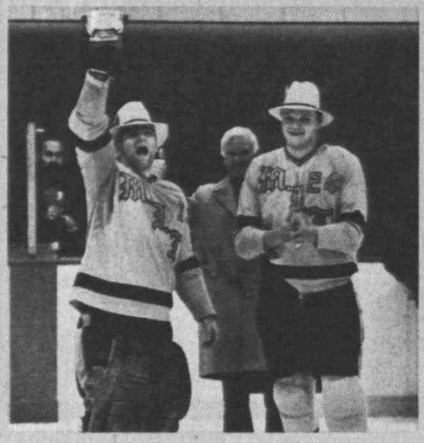
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ABOUT THE COVER

Peter Gasparini '88 (left) and Alex Jessiman '88 are jubilant as they accept the Beaver Cup from M.I.T.'s Director of Athletics Royce Flippin on behalf of fellow members of the Hockey Team. More on their second stunning defeat of a team from Caltech on page MIT 9. Photo: Stu Rosner.

Debt to Killian; Nurturing Idealists

KILLIAN'S PAPERS

Your readers should know that the late James R. Killian, Jr.,'26, played a key role in strengthening the Institute Archives and Libraries. All of Killian's official M.I.T. papers, as well as his personal papers, are housed in the Archives. (The Presidential Science Advisor collection is in the Eisenhower Library.) Killian was also responsible for transferring to the M.I.T. Archives the presidential papers of his predecessor, Karl T. Compton. These presidential papers, together covering the years 1930 to 1959, constitute the single most heavily used resource in the Archives.

In 1986 Killian donated his personal library to the M.I.T. Libraries. Included were three quite significant collections: first editions, letters, and private printings of [the 19th century British novelist and poet] George Meredith; several presentation copies and works signed by Alfred P. Sloan, Jr.,'95, Herbert Hoover, Eisenhower, Sir Winston Churchill, and John F. Kennedy; and a number of limited and first editions of important works in the humanities, science, technology, and the social sciences.

JAY K. LUCKER
Cambridge, Mass.

Lucker is director of libraries at M.I.T.

ENGINEERING FOR IDEALISTS

Thank you for Samuel Florman's eloquent suggestion that engineers should direct more of their technical ingenuity to humane purposes (*see "Engineering: An Ideal Profession for Idealists," October 1987, p. 18*). I was especially happy to see his reference to the Peace Corps, as I am currently a Peace Corps volunteer serving on the faculty of the University of Sierra Leone. Another M.I.T. graduate, Donald Kane, '84, is also here, teaching mathematics and science in an up-country secondary school. In addition, I know of alumni serving the Peace Corps in The Gambia, Botswana, Lesotho, Fiji, and the Dominican Republic. I'm sure there are others.

While I was at the Institute, companies like IBM and Megatest generated the vast majority of recruitment publicity; and the "Classes" section of the *Review* confirms that many M.I.T. graduates end up working in the defense industries or studying at business schools (or both). Yet every year a number of us head off into the Third World to help solve some of the problems here, while others donate their time and resources to the needy in the United States.

As a follow-up to Florman's essay, it would be nice to see a report on where M.I.T.'s idealists go and what they do.

MICHAEL D. THOMAS, '86
Sierra Leone, West Africa

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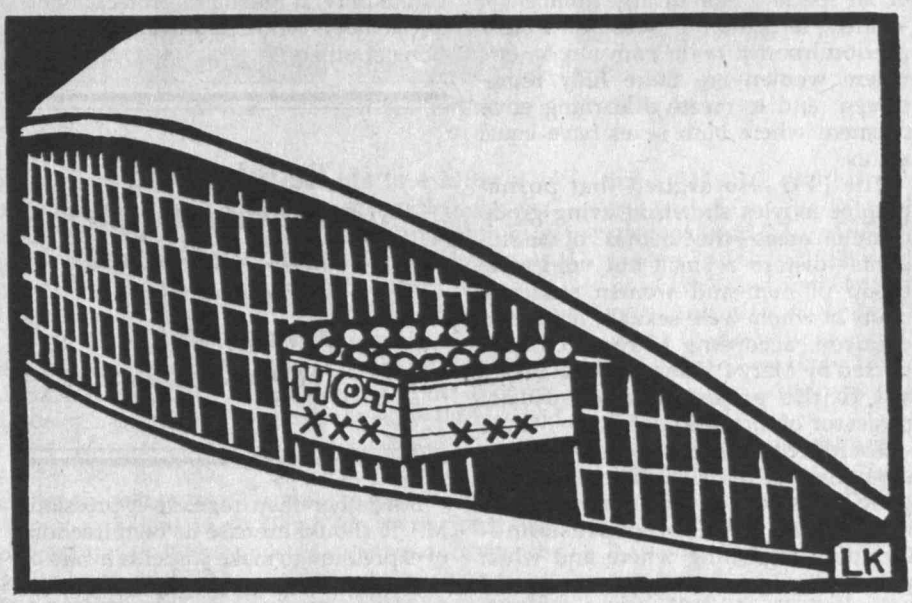


Faith P. Hruby, whose experience includes journalism, government service, and academic administration, has joined *Technology Review* as associate editor. She'll specialize in reporting Institute and alumni affairs for the M.I.T. section of the magazine.

Following graduation from Boston University, Hruby worked for the *Cleveland Press* and *US News and World Report*. For several years she was a member of Senator Howard Metzenbaum's Congressional staff, and more recently she has been the undergraduate academic advisor at the New England Conservatory of Music. □

BY THOMAS T. HUANG, '86

Freedom of Expression vs. Protection of Minorities



In February 1987, Adam L. Dershowitz, '89, challenged M.I.T.'s pornography policy by showing the movie *Deep Throat* to about 80 students in a dormitory lounge on Registration Day. In the process, he provoked the latest round in a debate that has divided the campus since at least 1983.

The Institute's present policy does not ban pornography, but does prohibit students from showing such films to the public at the beginning of the term—or at any time in Kresge, M.I.T.'s largest auditorium—without the approval of an Institute screening committee composed of faculty, staff, and students.

The administration's rationale is that showing pornographic movies on Registration Day and during Residence/Orientation week sets an inappropriate tone for the coming year.

When the Office of the Dean for Student Affairs filed charges against Dershowitz with the Committee on Discipline, the aeronautics and astronautics major cried "Censorship!" and declared that the policy infringed on his First Amendment rights.

In a disciplinary hearing last November, he called as an expert witness his uncle, Harvard law professor Alan Dershowitz, who claimed that the Massachusetts Civil Rights Act prevents private as well as public universities from abridging the constitutional rights of students.

At first, it seemed that Adam Dershowitz would succeed in his quest to have the policy rescinded. The Committee on Discipline found him innocent, arguing that the policy curbs the freedom of expression at M.I.T.

But no such repeal came. Shortly after the Dershowitz case was closed, the Faculty Policy Committee (FPC) reviewed the policy and advised the Academic Council (the final arbiter of such matters) to relax restrictions on the use of Kresge Auditorium while extending the policy's reach into the dormitories. Academic Council made it known that it was holding off a decision until interested groups or individuals had had time to discuss and comment on the FPC recommendations. That's where it stands as *Technology Review* goes to press.



THOMAS T. HUANG, '86, IS A GRADUATE STUDENT IN ELECTRICAL ENGINEERING AT M.I.T.; HE IS EXECUTIVE EDITOR OF THE TECH.

How Did We Get Into This Bind?

The existing policy, established in the summer of 1984, originally targeted the Lecture Series Committee (LSC), a student-run group that is the primary purveyor of movies on campus. LSC had shown X-rated movies as a fall and spring Registration Day "tradition" ever since the early 1970s, until women students' and religious groups pressured it into canceling the showing of *Deep Throat* in January 1983.

In May 1984, President Paul E. Gray, '54, met with LSC's leaders and questioned the values promoted by pornographic films. The chairman responded that his group was promoting "the simple value . . . that everyone should decide for themselves what's good and what's bad."

Finally, in the fall of 1984, with a new pornography policy under its arm, the M.I.T. administration decided that enough was enough and clamped down on the unfettered showing of sexually explicit films.

An uneasy truce prevailed, in which some students continued to complain that the regulations were restrictive, while others protested that *any* showing of pornography constituted degradation of women.

As the number of women students at M.I.T. has climbed sharply in recent years, the character of the community is changing. By 1986-87, women made up about 32 percent of the undergraduate students and 19 percent of graduate students. Administration members say that community standards must change as well.

In its recent recommendations to the Academic Council, the FPC stated that sexually explicit films contribute to a "male locker-room" atmosphere at M.I.T., in which women are viewed as sex objects, making it difficult for men and women to work in classrooms and

ILLUSTRATION: LES KANTUREK

laboratories as equals.

The FPC's policy suggestions are in line with what it describes as "the right of a private educational institution to set policies consistent with its own special purposes: . . . to open careers in fields of our specialization to large numbers of women, to make the transition from a predominantly male campus to one where women are more fully represented, and to create a learning environment where both sexes have equal status."

The FPC also argued that pornographic movies shown in living group common areas—the "homes" of the students—disturb a small but vulnerable group of men and women students, many of whom were sexually abused as children, according to research conducted by Mary P. Rowe, special assistant to the president and adjunct professor of management.

There are on campus, however, many supporters of the Committee on Discipline's position. They argue that curtailing any kind of expression—including regulating where and when pornography can be shown—could open up a Pandora's box, out of which could spring the censorship of other offensive expression, ranging from school newspaper articles to political protests.

Opponents of regulation contend that the screening committee's criteria for deciding which films are acceptable or unacceptable are too vague. The criteria require that the film promote a "positive attitude" toward sexuality, present "believable reality or normalcy" in relationships, and refrain from objectifying and portraying unfairly the "viewpoint and sexual feelings of men and/or women."

The FPC added: "Our primary concern is with films that present the physical abuse or degradation of women as sexually exciting and acceptable, and that have no redeeming social, artistic, political, or intellectual value."

But how does one decide which values are "offensive" and which are "redeeming," whose definition of "normalcy" shall be used, and who is qualified to make those judgments for a diverse community?

These questions pinpoint the weakness in M.I.T.'s attempt to control offensive expression. When one category of expression is regulated for "special purposes," all other categories become fair game for other "special purposes."

The pornography policy is a shortsighted attempt to reconcile M.I.T.'s two responsibilities: as an institution of higher education, it must uphold academic freedom; as the guardian of a community, it must also protect minority members who can be hurt by the actions of others.

Regulations do not address the violent and sexist attitudes that pornography represents.

But rather than regulate expression, M.I.T. should exercise its own freedom of expression to make students aware of the ravages of pornography and sexism in society. Students would then be left to decide for themselves how they should behave.

A Modest Proposal

Everyone agrees that the Institute must allocate its resources to educational and support programs that would enable women to feel comfortable here. To start, it should ask why so many students want to watch pornographic films in the first place. On Registration Day in the fall 1983, for example, three showings of the X-rated film *Take Off* sold out at Kresge, and a fourth overflow show was held in 10-250. In all, 2,600 tickets were sold.

Throughout the debate, M.I.T. has chosen to attack the symptom, not the sickness. Pornography may reinforce certain pernicious sexist attitudes, but regulating pornography does not destroy the root of those attitudes.

Ours is a society in which white males dominate the economic and political sphere—a society in which women and racial minorities have become targets for abuse. Something in our hearts makes us enjoy seeing others suffer—either that, or too many of us just don't recognize suffering when we see it.

M.I.T., then, has a role in sensitizing its students by exposing the suffering. Instead of trying to shove the offensive material into some corner, we must choose to confront the ugliness. After all, would we have gained very much if LSC never showed pornography and M.I.T. students took their business to theaters in Boston's Combat Zone?

In particular, I challenge the Institute to sponsor a campus-wide colloquium that would include living-group discussions following the screening of both a pornographic movie and an anti-pornography film, such as *Not a Love Story*, from Canada. M.I.T. should require its freshmen to attend seminars on sexism and racism in their first week here, to alert them to the issues inherent in a very diverse community.

I saw a pornographic movie in my second week as a freshman at M.I.T. That night, on the big screen, a man whipped a woman who was bound and gagged and hanging from the ceiling. After lashing the woman five or six times, the man entered her from behind. The act was over in about a minute, and the woman was left sobbing.

As a 17-year-old, I knew that people could hurt each other, but here I was seeing it on the screen—actually happening and filmed as a form of malicious entertainment.

Many of us were freshmen who had come to see sex. We ended up watching brutality and violence. We hadn't realized that the pornography industry makes its profits from the sexual abuse of men, women, and children.

The experience disturbed me and educated me about the horror of pornography far more effectively than any policy paper or brief on First Amendment rights possibly could have. But in itself, it was not enough to sensitize all of my classmates. The movie was a sellout and after watching it, several men called derisively to women living in McCormick to come down to meet them—the kind of actions, in fact, that led to the ban on showing pornography at Kresge.

We must do something more than regulate particular films. We must make students think about what pornography says about the people it portrays, the society that spawns it, and the people who watch it. □

Industries Endow Four Professorships

Major Gifts for Faculty

Four new endowed professorships, the result of gifts exceeding $5 million, have been announced at M.I.T. so far in 1988.

- The Boeing Co. has funded a faculty chair to honor its long-time chairman, Thornton A. Wilson, S.M.'53. The first Thornton Wilson Professor has not yet been designated.
- From the Dai-Ichi Kangyo Bank of Tokyo has come $1.5 million for a professorship in the M.I.T. School of Management, to which Glen L. Urban, deputy dean and professor of management science, has been named.
- A $1.5 million gift from the Mitsubishi Bank of Japan has endowed a professorship in finance, and Robert S. Pindyck,'66, of the M.I.T. School of Management has been named the first Mitsubishi Professor.
- David A. Rudman, assistant professor of electronic materials in the Department of Materials Science and Engineering, now holds the new Pirelli Career Development Professorship, made possible by Pirelli Societe Generale of Italy.

Thornton Wilson retired as chairman of Boeing at the end of 1987, after a career that began well before he became Boeing's first student in the M.I.T. Sloan Fellowship Program in 1952. Wilson's relationship with the Institute intensified after his year as a Sloan Fellow, culminating in his membership on the Corporation from 1968 to 1973 and again beginning in 1979. President Paul E. Gray, '54, describes Wilson as "one of our most dedicated trustees."



T.A. Wilson



G.L. Urban



R.S. Pindyck



D.A. Rudman

Wilson joined Boeing in 1943 after finishing his engineering degree at Iowa State University. He contributed significantly to designing the B-47 bomber, was overall project engineer on the B-52 program, and then led Boeing's participation in the Minuteman program. By 1963 he was vice-president, becoming executive vice-president in 1966 and president in 1968. He served as Boeing's CEO until 1986—a long period of major responsibility for one of the country's most successful engineering enterprises.

Glen Urban, who holds the new Dai-Ichi Kangyo Bank Professorship, works "at the forefront of marketing technology," says Dean of Management Lester C. Thurow. "He has spent his career in building management science models to improve the productivity of new product development." The donor of the professorship has a close relationship with the M.I.T. School of Management through the Sloan Fellowship Program; some 15 of the bank's executives have attended.

Another close relationship based largely on participation in the Sloan Fellowship Program, has developed between the School of Management and the Mitsubishi Bank. Pindyck, the first Mitsubishi professor, studied electrical engineering and physics as an M.I.T. undergraduate, then took his Ph.D. in economics here in 1971. He has been a member of the management faculty since then, specializing in the economics of natural resources and energy markets.

As a manufacturer of electronic materials and tires, Pirelli has an obvious interest in superconductivity, the field in which teaching and research are to be supported by the career development professorship. Rudman is an obvious choice: his research is on the fabrication of superconducting materials for electronic applications. Rudman has been at M.I.T. since 1984, and his three degrees are from Stanford. □

Campaign at $250 Million

By March 1, 1988, five months after its public kick-off with a nucleus fund of over $200 million, M.I.T.'s *Campaign for the future* has reached $250 million.

The program has thus achieved 45 percent of its $550 million goal, reports Carl M. Mueller, '41, chairman of the Corporation Campaign Committee. That puts it comfortably ahead of the schedule originally plotted by Mueller and his colleagues. (All gifts and pledges to M.I.T. made between January 1986 and June 1992, and unrestricted gifts and gifts to endowment made between July 1984 and December 1985, are being credited to the campaign.)

It's a clear demonstration, said Mueller, of the truth he learned as a student at M.I.T. half a century ago: "To accomplish anything you have to work like mad." And that's what been happening, he said, for more than a year, with staff and volunteers alike making major efforts.

Though the stock market drop of last October 19 may have cast a shadow over some donors' plans, Glenn P. Strehle, '58, vice-president and treasurer, is optimistic. "Many donors have made the largest gifts of their lifetimes since then," he reports. And D. Reid Weedon, '41, chairman of the national campaign committee, calls the "crash" at most "a temporary setback."

Over $120 million of the gifts and pledges have come from individuals—alumni ($103.5 million) and other friends ($18 million). Corporations and corporate foundations have given more than $63 million, and $65.5 million has come from other foundations and charitable trusts. □

PHOTOS: M.I.T. NEWS OFFICE

UNDER THE DOMES

Support for Biology from Hughes

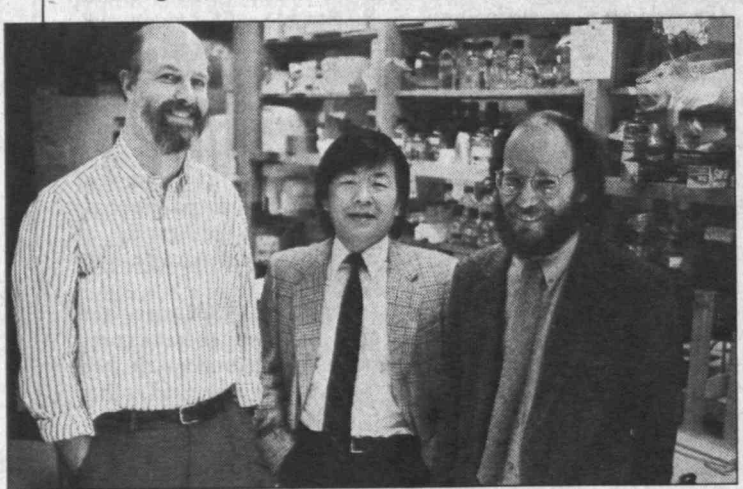
The Howard Hughes Medical Institute (HHMI) of Bethesda, Md., will provide long-term support for three outstanding members of the M.I.T. biology faculty and will make a major gift of $15 million to cover more than half of the cost of a new biology building in which the Hughes Professors will work.

The faculty who will benefit from HHMI's full salary support and partial research funding are H. Robert Horvitz,'68, Richard O. Hynes, Ph.D.'71, and Susumu Tonegawa. All three hold the rank of professor in the Department of Biology, and they will continue to function as M.I.T. faculty members under the HHMI funding.

Horvitz is working on the genetics of development and behavior. Hynes, who is associate department head, is a specialist in the molecular mechanisms by which cells attach to their surroundings and to each other. Tonegawa is widely recognized for work on fundamental processes governing the immune response; he won the 1987 Nobel Prize for work in this field.

The new biology building, the major academic facility included in the goals of the *Campaign for the future*, will be built on the site of the former TRW/United-Carr fastener factory at the corner of Main and Ames Streets in Kendall Square.

HHMI has heretofore devoted its resources to establishing and supporting large research units at existing medical centers and universities. This M.I.T. program marks a change, with the organization now emphasizing the support of individual scientists in a variety of institutions that have scientific programs involving hospitals. □



M.I.T.'s first Howard Hughes Medical Institute investigators are (left to right) Professors Richard Hynes, Susumu Tonegawa, and Richard Horvitz.

Celebrating Materials

A century of metallurgy and materials science at M.I.T. will be celebrated with a plethora of alumni events during the first four days in June.

Beginning on June 1, Course III alumni will gather for a centennial program that includes a department open house, a gala birthday banquet at the Museum of Science, and sessions on the past, present, and future of materials science and engineering, with prominent faculty and alumni as speakers.

On Thursday evening, June 2, the Course III alumni will join other reunions for Tech Night at the Pops, and on Friday morning of Technology Day there will be an all-M.I.T. program on "Materials, Productivity, and National Well-Being." Speakers: Morris Cohen, '33, Institute Professor Emeritus; Richard F. Polich, S.M.'65, president of Tallix Art Foundry; Richard P. Simmons, '53, chairman and chief executive officer of Allegheny Ludlum Corp.; Morris Tanenbaum, vice-chairman of AT&T; and Lester C. Thurow, dean of the M.I.T. School of Management.

Cohen is chairman of the department's Centennial Committee, and further information is available from his office, (617) 253-3325. □



M.I.T.'s first national record in swimming was set by Yvonne Grierson, '90, in the NCAA Division III championships held this March at Emory University in Atlanta. Grierson won the 100-yard butterfly with a time of 56.18, breaking the existing Division III record by more than half a second. The sophomore from Ann Arbor, Michigan, was named All-American for that victory and a third-place finish in the 200-yard butterfly.

Frat Honors

Two honors came to the M.I.T. Chapter of Phi Delta Theta at the fraternity's general convention late in 1987:

□ The Silver Star Award for overall fraternity excellence.

□ The Stan Brown Community Service Trophy, awarded to honor the fraternity's annual Christmas toy project. In 1987 the chapter made more than 700 wooden toys that were donated to Boston-area children's hospitals. □

PHOTO: DONNA COVENEY, M.I.T. NEWS OFFICE/JET COMMERCIAL PHOTO, INC.



A UROP project for Blair Cohen, '88 (right) and graduate student Laura Damsetz involved "Wallbott," an automated wall-building machine developed in the Civil Engineering Department.

How Do We Rate?

After surveying the judgments of more than 760 college presidents, *U.S. News & World Report* ranked M.I.T. eleventh among all U.S. universities late last year. The Institute was first in undergraduate science programs, first in graduate engineering programs, and fourth in graduate business education, according to the presidents' polling. □



A. B. Giamatti

Giamatti to Speak at Graduation

Former president of Yale University, A. Bartlett Giamatti, who is now president of baseball's National League, will be the Commencement speaker on May 27.

President Paul E. Gray, '54, whetted the community's appetite for the Commencement address by noting in his announcement that Giamatti will bring "academic accomplishments, universality of interests, and wit that epitomize the truly educated person" to the M.I.T. platform.

Barring severe weather, the Commencement exercises will be held in Killian Court. Among the guests, in addition to parents and friends of the graduates, will be members of the 50-year Class of 1938. □

They're All Copying UROP

In the vocabularies of M.I.T. students and faculty—and of most alumni—UROP is an everyday word. (For the few who may be uninitiated, it's the acronym for M.I.T.'s hugely successful Undergraduate Research Opportunities Program.)

Now UROP—the idea, at least, and sometimes even the acronym—is alive and well on at least 15 other campuses in the United States, and the second annual National Conference on Undergraduate Research is drawing several hundred faculty, student, and administration delegates from throughout the U.S. to the University of North Carolina (Asheville) this spring.

It is "a new revolution" in undergraduate education, writes Michael P. Doyle of Trinity University, San Antonio, in the newsletter that he edits for the Council on Undergraduate Research. Undergraduate research has become so respectable that the National Science Foundation's new program of Research Experiences for Undergraduates (REU) awarded over $5 million in its first year (fiscal 1987).

It all began at M.I.T. in 1957, when Edwin H. Land, then founding president of Polaroid Corp. and a visiting professor at the Institute, lectured on the importance of having students learn by being colleagues of academic mentors—not simply by sitting in classrooms. A decade later Land gave M.I.T. a gift designated specifically for educational innovation, and the money was used to fund an experimental UROP that opened its doors in 1969. It was put together by Margaret L. A. MacVicar, then professor of physics, who continues to be UROP's strongest advocate as dean for undergraduate education.

Some 300 students signed up that first year, and "the rest is history." More than 75 percent of M.I.T. students now have at least one UROP experience during their four years of undergraduate work. In chemistry, 95 percent of undergraduate majors work on UROP projects, integrated so thoroughly with faculty, graduate students, and research staff that their undergraduate status is hardly an issue. Over $3.3 million, mostly in sponsored research funds, was paid as stipends to UROP students in 1987, and several hundred others elected to receive academic credit in lieu of money for their work.

Other schools began watching UROP almost from the beginning. At first there was a good deal of skepticism, remembers Norma G. McGavern, UROP's chief administrator. But by the late 1970s, "when it became clear that UROP wasn't going to die," that mood changed. In 1981 the University of Delaware had broken the ice with an undergraduate research program of its own—that was modelled after M.I.T.'s.

Then came a trickle of others—Rensselaer, Minnesota, SUNY at Stony Brook, Imperial College (London), Stanford, UCLA . . . Now every year brings a dozen or more "serious" requests for information and consultation from institutions considering their own UROP-type programs.

To further spread the word, MacVicar invited several of M.I.T.'s UROP enthusiasts and administrators of undergraduate research programs at several other universities to report to members of the American Association for the Advancement of Science in Boston last winter.

All who spoke stressed the importance of flexibility and of designing programs that fit the particular needs of the institution where

PHOTO: M.I.T. NEWS OFFICE/LAURIE SOKOLSKY



Joyce Wong, '88, photographer for **The Tech**, *traveled to Calgary to catch this training shot of speedskater Jan Goldman, '89.*

they're located. In M.I.T.'s case, the critical strength was faculty research resources; the critical condition was flexibility in accommodating irregular hours, varying credits, and negotiated funding arrangements; and the critical mindset was tolerance for variety and independence on the part of both faculty and students.

"By definition, you do research on subjects about which you know too little," said Robert W. Mann, '50, M.I.T.'s Whitaker Professor of Biomedical Engineering. So students are likely to be confronted with "unstructured situations—where [their] responsibility is to determine what the problem is, how to address it, and how to get useful results. I categorically *will not* give a student a recipe for research," said Mann. □

Olympian Skater

Jan Goldman, '89, may not have brought home any Olympic medals from Calgary, but she left a big mark by breaking two U.S. records in speedskating. While Bonnie Blair was earning her gold in the 500- and bronze in the 1,000-meter distances, Jan was bettering the U.S. times in the 3,000-meter (she came in 11th in 4:25.26) and the 5,000-meter races (10th place with a time of 7:36.98). A junior from Illinois who took the fall semester off to train for the 1988 Winter Olympics, Goldman also raced in the 1,500-meter event, where she placed 18th.

Jan was spotted on television during a special ceremony for skater Dan Jansen to award him the Maxwell House Medal for persistence. The entire U.S. speedskating team was on hand for the presentation, and there in the back row was a familiar M.I.T.A.A. sweatshirt.

M.I.T.'s other Olympian, Alexis Photiades, '91, represented Cyprus in Alpine skiing. Both athletes also competed in the 1984 Sarajevo Winter Olympics. □



It's the beginning of a "technology corridor" between Quebec and M.I.T., said Pierre MacDonald (right), Quebec's minister of external trade and technology development. MacDonald is shown with David S. Saxon, '41, chairman of the Corporation, signing a unique agreement making his government a member of the Industrial Liaison Program. A consortium of 10 Quebec companies has been formed under Quebec's ILP membership.

Tuition Up, Aid Increased

The average cost of tuition, room, and board for M.I.T. students in 1988-89 will be $18,040, up 6.3 percent from this year's $16,970.

Tuition alone will go up 7.2 percent, increasing by $900 to $13,400.

Meanwhile, the "self-help" level—the amount an undergraduate is expected to earn or borrow before receiving scholarship assistance—will stay at $4,900, unchanged for the fourth year in a row. This has the effect of softening the blow of increased expenses for needy students.

Furthermore, there is a new program of "opportunity grants" for economically disadvantaged undergraduates. Beginning with next fall's freshmen, M.I.T. will offer 125 additional scholarships of $1,500 to $2,500 for needy students, according to Leonard V. Gallagher, '54, director of student financial aid. The effect will be to lower (by the amount of the scholarship) the self-help requirement for each recipient.

The Academic Council, which reviews annual tuition changes, is reported by James J. Culliton, vice-president for financial operations, to have considered an increase in self-help to $5,300. But Manuel Rodriguez, '89, president of the Undergraduate Association, "made a really strong pitch that this would not be a good idea," Culliton told *The Tech*. □



Soviet cosmonaut Aleksiev Eliseev and his interpreter slipped away from a Boston tour group late last winter—he wanted to visit M.I.T., he said. To a hastily gathered group of aeronautics and astronautics students, Eliseev argued for manned space missions. Unmanned orbiters are fine, he said, but "the human presence is very important, because you can't really plan for the unexpected." Would the Soviets work with the U.S. on a space venture—perhaps a flight to Mars? asked a student. "A joint U.S.-Soviet space project could only be beneficial," answered Eliseev. How about a Soviet-U.S. exchange of students? "We would be interested."

PHOTOS: JOYCE WONG '88 FROM THE TECH/DONNA COVENEY

Discussion of Course XX Draws Crowd

Faculty, students, and staff filled the seats and spilled into the aisles of 10-250 for the faculty meeting on March 16, when the entire agenda related to the dissolution of the Department of Applied Biological Sciences (ABS).

After almost three hours of intense discussion, the faculty voted 119 to 96 to postpone until May action on a motion "deploring the absence of due process in disbanding the department." The motion also called for action to clarify the positions of ABS faculty and graduate students and to develop clear policies governing the closing of academic units.

The decision that ABS would cease to exist as of July 1 was made by President Paul Gray, '54, Provost John M. Deutch, '61, and Dean of Science Gene Brown, who all spoke at the faculty meeting. They had judged that the department lacked a coherent focus and that "the most important academic activities in the department . . . could be pursued more successfully at M.I.T. in different organizational settings," Gray said (*see April, page MIT 5*).

The president said that the administration made "wrong assumptions" about the degree to which ABS faculty had been involved in or apprised of earlier discussions of the department's organizational problems.

When the decision was announced in January, members of the department were caught totally by surprise, and no arrangements had been made for the relocation of faculty and graduate students—two aspects of the situation that every speaker at the meeting criticized. In the words of Professor Louis Smullin, S.M.'39, "the message has been loud and clear that this action . . . was ill considered and couldn't have been done in a worse way."

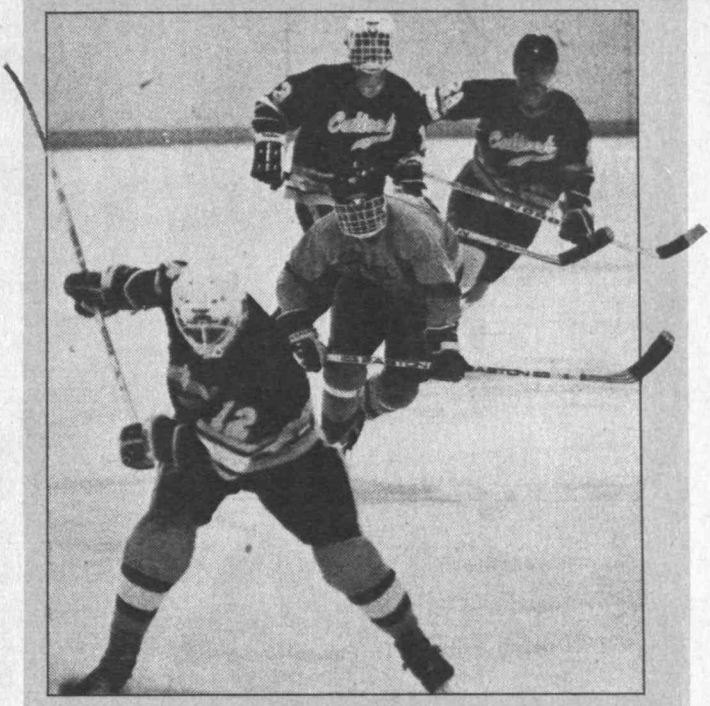
Professor Robert W. Mann, '50, noted that M.I.T. is disbanding ABS at a time when many institutions in the U.S. are increasing their support for applied biology.

In making a motion to postpone action, however, Smullin noted that reports from the administration and from Chair of the Faculty Bernard Frieden, Ph.D.'57, indicated that many of the motion's provisions were already being addressed.

The faculty voted unanimously to support what was described as a "statesmanlike" motion from the members of ABS calling for the creation of a committee to review the process of closing ABS, consider the lessons to be learned, and recommend future policies. The committee is to report to the faculty in May.

Tech Talk of March 30 reported that new appointments have been offered to all 16 active faculty in ABS (11 had accepted them, five were yet to announce their plans), and a committee had been formed to help graduate students relocate to other departments or finish their degrees in Applied Biological Sciences. □





Combat on Ice: M.I.T. & Caltech

One of the biggest crowds ever to witness a hockey game at the M.I.T. rink was on hand February 27 to watch M.I.T. and Caltech play the second annual Beaver Cup competition. For the second time in the two-year series, the West Coast school was severely trounced, but for the local alumni and alumnae of both institutions who filled the stands, the high spirits engendered by the occasion outweighed any anxiety about the score.

In fairness, we should note that club hockey at Caltech involves post doctoral fellows, faculty, and staff along with students (their player-coach at 38 is the oldest member of the team), and it is difficult to arrange ice time for practices.

When the game was played in Pasadena last year, the local press called it a "collision" between "archrival brain factories." □



Caltech President Tom Everhart (left) with Paul Gray, '54.

PHOTOS: STU ROSNER



ABOVE: DEAN LESTER C. THUROW; PHOTOS BY MICHAEL LUTCH



Preparing Managers for an Era of Technological Supremacy

By Faith Hruby

Broad changes in scope and direction are being plotted for the Sloan School of Management by its dean, Lester C. Thurow, and his faculty, students, and alumni. Thurow's purpose, discussed in a series of meetings last winter, is to adapt quickly to the business and industrial needs of the future and to emphasize the school's resonance with M.I.T.'s world-class image in science and technology.

"We should be producing students who are the best in the world at managing technological change," says Thurow in a mission statement.

The school will be positioned at the vanguard of top business schools, says Dean Thurow, by anticipating major changes in management theory and practice, by developing its sometimes undervalued assets—among them its integral role at M.I.T.—into the strengths they really are, and by opening its whole process of evolution to input from its richest resource—its students and alumni. Toward that end, Sloan is becoming the M.I.T. School of Management as part of its marketing strategy.

Embrace Technology, Don't Fight It

At several student forums during the Independent Activities Period (IAP) in January and an alumni/alumnae gathering at Sloan in February, Thurow elaborated upon the school's new mission statement developed last fall after broad discussion among deans, faculty, and staff. The mission in that statement reads: "To be the recognized leader in the development and dissemination of knowledge for improving management in the context of a global economy with increasing technological competition and the need for more rapid organizational change."

Students and graduates were invited to comment on the statement and make suggestions for its implementation.

The turn-out at the various meetings was impressive: nearly 100 students and more than 60 alumni. Other alumni responded to the issues Thurow raised with detailed and incisive letters; excerpts of a number of these were read aloud at the alumni gathering. One alumnus at the meeting commented wryly that this was the first time he'd been asked for anything other than money: clearly the opportunity to participate was appreciated.

The alumni and students endorsed three major areas of change Thurow described:

1. Internationalize M.I.T.'s Management School so that its graduates are ready to be effective managers in the global dimensions that have permanently altered the American economy.
2. Emphasize the technical know-how that students will need to have

Alumni of the School of Management (left) listen to Deputy Dean for research Glen L. Urban (center) during the February conference on Sloan strategy. After presentations by Thurow, Urban, and Deputy Dean for teaching programs Arnoldo Hax, there was lively discussion (right).







the edge in increasingly sophisticated technological markets.
3. Teach the skills necessary for managing social, organizational, and political change.

At each of the meetings, Thurow referred to Sloan's "shadow" problem. As a part of M.I.T., Sloan has been identified as a quantitative, technically oriented business school. In the past, it has sought to escape from under M.I.T.'s shadow in order to look more competitive with the first-rank qualitative programs of schools like Harvard and Stanford. Now, says Thurow, instead of fighting an image that actually gives the school a strong niche of its own, the consensus is to embrace it while continuing to strengthen the balancing international and human factors.

Toward World-Wide Education

The proposals put forth by the Sloan administration to internationalize students and faculty include:

■ A tripartite three-year master's program that is now under discussion with Harvard's Regional Studies Program and the Harvard Business School.

■ International summer internships (possibly tied to M.I.T.'s Industrial Liaison Program).

■ Faculty and student interchanges with some of the more than 40 business schools around the world that have expressed just such an interest to Thurow. The first exchange agreement was signed in March with the IRI Management School in Naples, Italy.

■ A language proficiency requirement for master's and doctor's recipients—possible only, Thurow admits, if a similar requirement is adopted by other top schools.

Since the meetings with students and alumni, Thurow has announced a three-year dual master's degree program in management and international relations with the Fletcher School of Law and Diplomacy at Tufts University.

To improve the ability of its graduates to manage technological change and to increase the school's visibility as a logical source of managers with that orientation will require revised teaching and research initiatives. Some ideas include:

■ A formal "minor" for engineering, science, and humanities majors who want to take management subjects. As a result, such students would be more integrated into the school while they are here and more representative of its programs once they are out in the world.

■ Vigorous participation by faculty and students in the new Leaders for Manufacturing Program, a joint engineering and management program currently under development (*see box*).

■ Encouraging businesses to turn to Sloan as a primary resource for help on problems of developing and applying technology—as well as for students who can rise to these challenges—which are ubiquitous in management today.

■ "Cross-fertilization" of Sloan students by requiring that a portion of their degree programs be devoted to technology subjects in other M.I.T. departments.

Debunking the Two-Culture Myth

When the forums turned to the third major thrust— managing social, political, and organizational change—discussion focused on several possible initiatives:

■ Devise integrative projects that teach students how to work in teams and how to bring diverse people and resources into a unified and functioning group.

■ Develop a management "flight simulator" along the lines of the models now used by medical students to practice diagnosing and treating patients.

■ Give increased visibility to the strong human-behavior component that is already in the curriculum—and too little appreciated.

■ Debunk the self-perpetuating notion that math and verbal skills are mutually exclusive. Thurow calls this the two-culture myth, and he attributes to it many popular misconceptions about both M.I.T. and its management school. Qualitative and quantitative approaches are not antithetical, he emphasized, and management courses would be an ideal place to start demonstrating this.

Forgivable Loans and Postdocs

The discussions often turned to money. Competitively, Sloan has been handicapped by the fact that its endowment is much smaller than that of other schools in its league. A bigger endowment would help the school to attract more top faculty and to compete more effectively for students.

Being relatively young, it has far fewer alumni than other schools on whom to rely for financial support. And because its graduating classes are as little as one quarter the size of some others, the donor pool will grow slowly.

However, Thurow reported that Course XV alumni and alumnae have been among the most generous contributors to M.I.T., and the school is making special efforts to stimulate giving from all its constituencies.

Candidates for faculty positions are becoming an endangered species as the number of people receiving Ph.D.s in management decreases. It's harder to justify staying on for a doctorate to prepare for a teaching career when a master's graduate can earn significantly more in the business world without struggling for a Ph.D., Thurow said. One proposal: offer forgivable loans for doctoral students who elect to teach as a career. Those who don't teach pay back the loans. Another idea: offer a one-year postdoctoral program for people with Ph.D.s in other fields that would qualify them to teach management.

How Do We Stack Up?

As M.I.T.'s management school emphasizes its quantitative qualities and ties with M.I.T., will prospective students be put off by the calculus exam, the thesis requirement, or general faint-heartedness about technology? The administration is tackling these issues, examining new approaches, for example, to thesis fulfillment.

Sloan attracts a slightly different, but overlapping, group of applicants than the other top schools; since it does not want to be identical to those schools, that is as it should be. The students attending the forums believe that Sloan provides a more humane and less coldly competitive environment than, say, Harvard. But, they said, this isn't widely recognized: Sloan isn't particularly *known* for its warmth.

In addition to the need to capitalize on more of the school's hidden assets, the students emphasized that the school's physical environment should be significantly improved to reflect the collegial, intellectual atmosphere that already exists—and that ought to be enhanced. □

A Renaissance for Manufacturing

■

For several decades, manufacturing has been considered a relatively unglamorous and less lucrative career option for engineers and managers, who have often chosen instead to pursue such avenues as research and design. This attitude is reflected in the struggling performance of the U.S. economy.

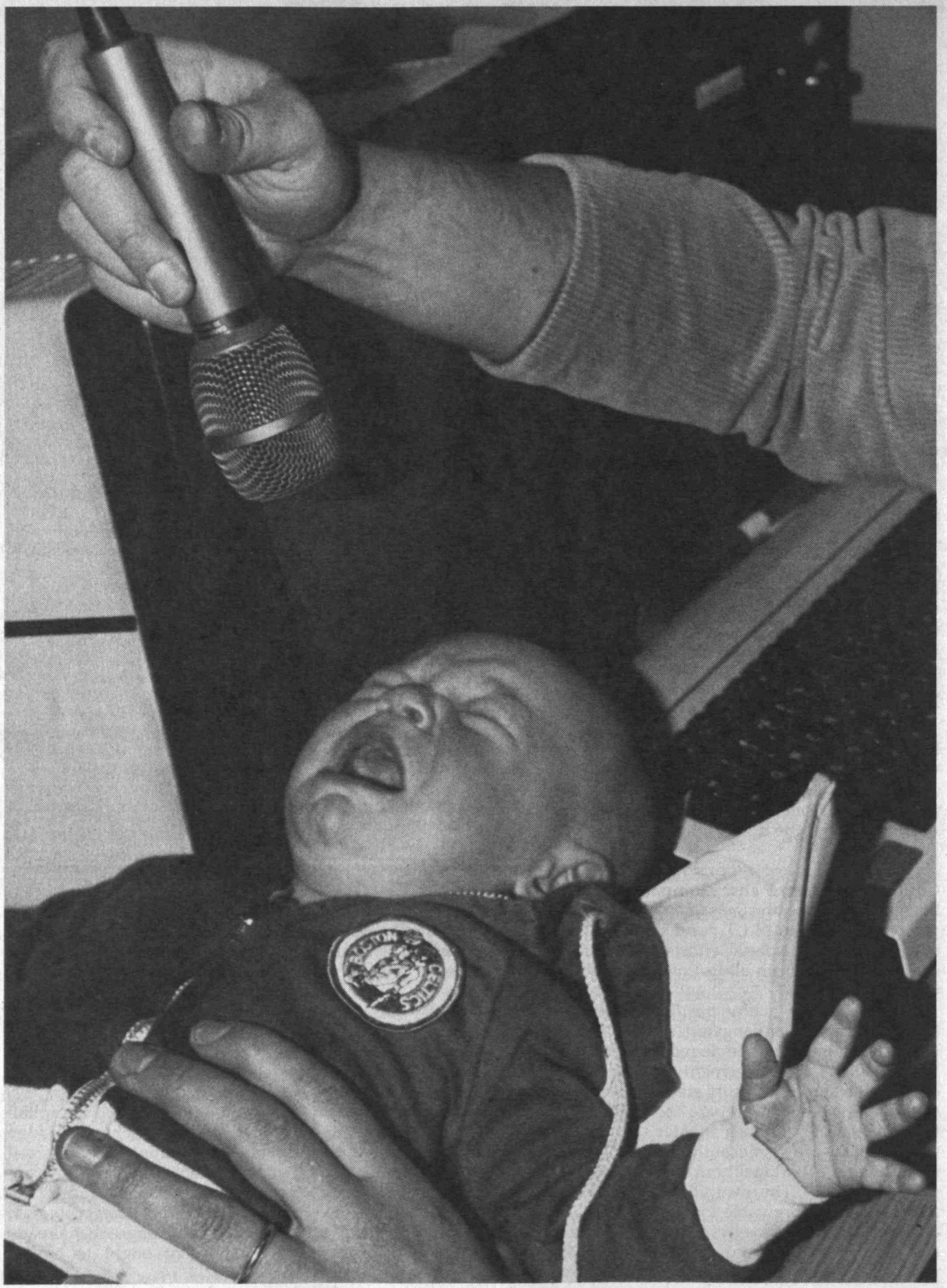
In order to reverse this trend, private industry is joining M.I.T. to establish a program designed to encourage the best and brightest students to enter careers in manufacturing. The program, known as Leaders for Manufacturing, will equip students with the skills needed to implement technology in industry. The partnership will address the integral restructuring needed in both industry and education to help restore American competitive viability in the international arena.

Making the necessary changes in teaching, research, and professional approaches will entail the development of new educational models that stress teamwork, diversity of abilities, and leadership skills as well as a solid understanding of technology.

M.I.T. is negotiating final contracts with eight to ten leading American firms. The participating companies will contribute both money and people; in addition to general support and guidance, they will provide ideas for new subjects and executives to work with faculty on research and teaching initiatives.

The program is structured on the premise that the fundamental changes needed in education and manufacturing will not respond to a "quick fix," according to Eric C. Johnson, '67, assistant dean of the School of Engineering. This unique collaboration of industry with engineering and management education offers the opportunity to investigate long-range, broad, and complex improvements in the country's manufacturing methods.

The joint program is to be offered by the School of Engineering and the School of Management. It will be launched this summer with 20 entering graduate students, one half of the anticipated ultimate enrollment. During the two-year program, each candidate will complete two full master's degrees, fulfilling the basic requirements of each school and writing a single thesis. Six months of those two years will be spent on-site in industry, working on a specific project. □

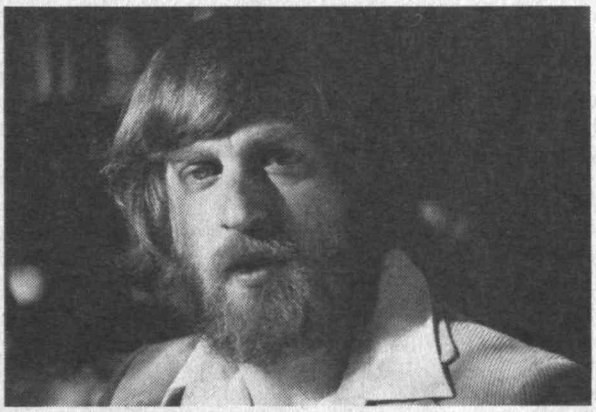


HOWARD GOLUB, PH.D.'79

For some babies, a cry may be more than a call for food and cuddling; it could be the first warning signal of possible "crib death."

The Telltale Cry

By Steve Nadis



Howard Golub, Ph.D.'79

Howard Golub, Ph.D.'79, is trying to detect babies at risk of sudden infant death syndrome (SIDS) and of developmental delay—a mild form of brain damage that handicaps untold numbers of youngsters worldwide. Golub has drawn on resources from electrical engineering, computer science, and medicine to improve on a strategy parents have used for several millenia: interpreting the crying of infants.

He developed a career that combines entrepreneurship, scientific research, and powerful humanitarian purpose, and he did it, in part, by spending a lot of time finding a match between his seemingly disparate interests and by spending a daunting number of years in school.

As a graduate student at M.I.T., Golub faced a familiar dilemma: he had a hard time settling on a dissertation topic that covered the range of his interests—electrical engineering, acoustics, auditory perception, and physiology. An exhaustive search led him to the analysis of infant wailing.

"Cry has been around ever since people existed," Golub said. "It's something everyone knows, everyone has heard. I just wanted to figure out how it is produced and what it means."

Golub secured funding from the National Institutes of Health (NIH) and enlisted Professor Kenneth Stevens, Sc.D. '52, as his advisor." [Stevens] was the first guy who didn't laugh at me," Golub said.

Golub developed a "cry production model" for his Ph.D. thesis. In the process, he found that "all this cry stuff got me more interested in medicine." So he enrolled at the Harvard Medical School, earning an M.D. degree in 1983.

While still a medical student, Golub founded Pediatric Diagnostic Service, Inc. (PDS)—a Cambridge-based company that performs a number of medical tests. One of the company's major projects is to develop cry analysis as a means of detecting the risk of SIDS (sometimes referred to as "crib death") and developmental delay. The firm now has some 65 employees spread across the country, a roster that includes just about every American active in cry research.

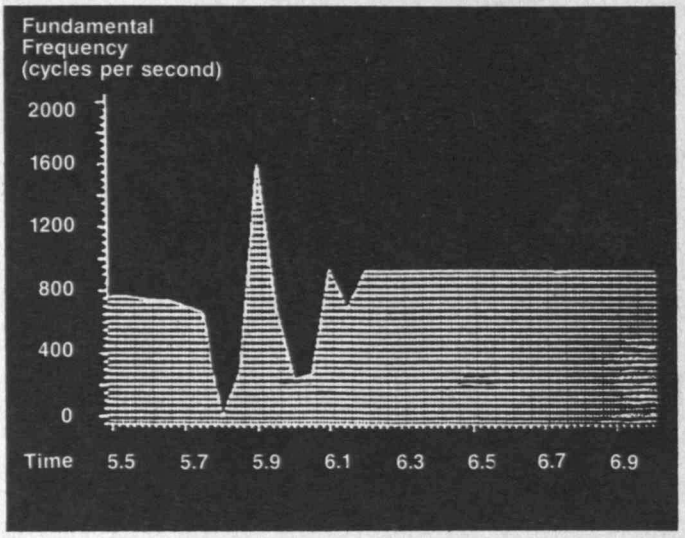
No one knows whether you can prevent SIDS or developmental delay, Golub says. "But most people feel that the earlier you know [that a child is at risk], the better."

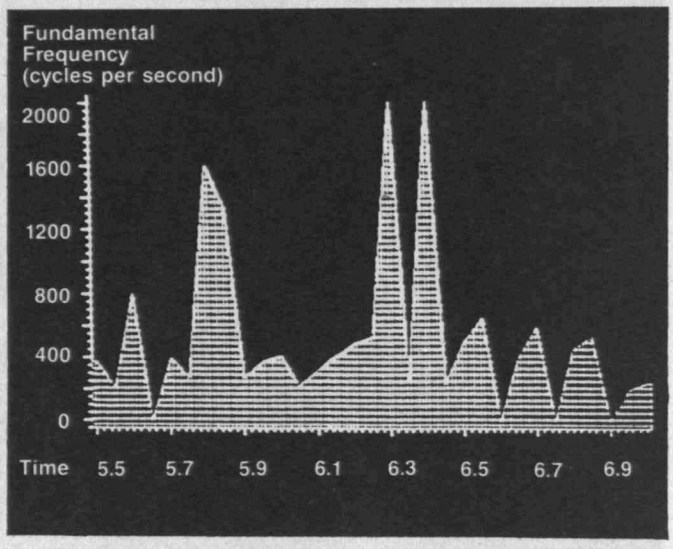
For example, SIDS might be preventable by treating high-risk infants with medication or by having them wear apnea monitors—devices that signal when the wearer stops breathing. And for children whose development is for some reason slower than normal, a whole array of special education techniques is now available. But in the large number of cases where developmental delay is not detected, the children may be labeled troublemakers or even become juvenile delinquents, when in fact their underlying problem is learning disabilities. "In any case, you first have to detect the problem if you're going to have a chance of treating it."

Although PDS is the only company in the business, cry analysis itself is not new. "It's been around since 300 B.C.," Golub said. Hippocrates was the first physician on record to expound the art of "diagnostic listening," suggesting that medically useful information could be obtained by listening to breathing, heartbeats, or a baby's cry. This art was largely ignored until 1855, when Charles

PHOTOS: NINA TOVISH

These are fundamental frequency (pitch) plots over time for a cry utterance of a normal baby (left) and a baby with brain damage (right). Notice that the cry of the baby with brain damage has more peaks and valleys.





Darwin tried to correlate infant cries with various expressions of emotion.

Technology entered the picture in the 1960s, when researchers began using a sound spectrograph in an effort to match patterns of cries with different medical problems.

One problem confronting investigators at that time was the lack of a good acoustical model showing how crying is produced. "The trouble with infant cry is not too little information, but too much," Golub explained. "Once you have a model of something, you have a higher probability of measuring important things and ignoring the unimportant ones." His model shows what a baby has to do—anatomically and physiologically—to produce a cry. If there is something peculiar about that sound, the model can help explain what might be causing it. For example, a brief, low-amplitude cry may indicate a child suffering from respiratory problems.

Cry researchers in the 1960s were also hampered by the limitations of pre-computer technology. The spectrograph results had to be recorded and analyzed individually, and the device's output was difficult to interpret. The painstaking work with the spectrograph, however, was able to show that sick babies do cry differently.

"Of course, mothers have known this since creation. By listening to the cry, they can tell instinctively whether their own babies are sick or well," Golub said. "Intensive-care nurses have also said, 'I knew something was funny about that cry.' The trouble is, it's not easy to hear in all cases, only in some. And even if it sounds funny, you still don't know what's wrong. That's why we've computerized the analysis."

Computer hardware and software developed by Golub can "listen" to tape recordings of infant cries and complete an acoustical analysis within a few minutes. "It's like being used to getting around on a bike, and then someone gives you a Maserati," commented PDS engineer Ivan Basch. "You get there a lot faster."

Cry recordings are taken during blood tests administered to newborns on their second or third day of life. The first recordings using Golub's system were made in 1978 by Michael Corwin M.D., a neo-natalogist at Boston City Hospital and the Boston University School of Medicine, who now supervises testing at several hospitals in the Northeast.

There is no charge for cry analysis, Golub said, nor does PDS make clinical recommendations based on the analysis. "At the moment, it's pure research."

With the help of an NIH grant, Golub, Corwin, and Barry Lester, a developmental psychologist at Brown University, have launched two major studies that will take three to four years. The first study, now under way at 12 medical centers, is examining the cries of 55,000 babies to determine whether SIDS can be predicted by cry analysis. The second involves following 600 babies through the first few years of life to see whether their cries can indicate future developmental problems.

"We need to produce hard scientific evidence that this is worth looking at," Golub said. "If it's shown to be medically useful, I'd like to see cry analysis used on every baby as a routine screening test, just like the standard blood tests." If that happens, Golub would like to see PDS put its cry tests on a commercial basis, contracting with hospitals to do the work. There are currently about 4 million babies born every year in the U.S. alone, so this could become a booming business.

"The technique can be used in developing countries," he added. "All you need is a cassette recorder. The tapes can be mailed into a medical center that has a computer."

Corwin is optimistic that cry analysis will prove to be a useful diagnostic tool. "Obviously," he said, "you don't undertake a study of 55,000 screaming babies unless you have some reason to believe it's worth the effort." □

STEVE NADIS is a frequent contributor to TECHNOLOGY REVIEW.

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CLASS NOTES

11

Edward Sisson, 99, of Newton, Mass., who had been president of the American Architectural Iron Co., for 30 years until his retirement in 1962, died last October 1987.

He was a member of the Boston Rotary Club and had been a member of the Everett C. Benton Masonic Lodge, Boston, a guardian and former trustee of Temple Ohabei Shalom, Brookline, and a past president of the Metal Fabricators Association of Boston.

He leaves his children, Dr. Richard G. Sisson of St. Louis, Kenneth S. Sisson, and Marjorie Kapsten, both of Newton; eight grandchildren, and three great-grandchildren.—*ed.*

17

Phyl and Don Severance, '38, report that last February they stopped to see **Stan Dunning** in Concord, N.H. They had a delightful visit with wide-ranging conversations about their respective families and friends of M.I.T. and the Skating Club of Boston, where Stan and Jeannette had long been members and Stan himself had figure skated. Stan was very pleased to have heard by phone from **Ray Brooks.** Stan was temporarily at the Concord Hospital and anxious to be returning to his own room at Havenwood.

This month the sad news is the passing on June 1, 1987, of our loyal classmate, **Winthrop C. Swain,** of Hingham, Mass. Winthrop graduated in civil engineering following his bachelor's degree from Harvard College. Like so many of our class, he served in World War I—he was an army major in the heavy artillery.

Following the war, he joined the staff of Moody's Investors Services, where he was a department head. In addition to his various positions as a highly regarded financial analyst and as an investor in several Boston area businesses, he also held important government positions, including assistant to the chairman of the Washington, D.C. Public Utilities Commission. A few years later he served during World War II as an analyst with the Federal Board of Economic Warfare in Washington. Following World War II, he moved to Hingham where he had lived ever since.

Winthrop is survived by his wife, Elizabeth, two daughters, six grandchildren, and one great-grandson. Our sympathy goes out to Elizabeth and their family.—*ed.*

18 70th Reunion

Congratulations to **Len Levine** on celebrating his 91st birthday. In addition, at this late date, here is his response to my year-end greeting to all of you: "I was delighted to receive your Christmas card and immediately put the picture of M.I.T. in front of my desk to replace the one you sent me last year. Sorry to hear that our class has dwindled to 38—and to note that we are getting closer to the front of 'alumni data' in the *Review.*

"My routine is not exciting but at least persistent—bridge, Retired Men's Club in Newton and Brookline, Boston University Evergreen. I have found these organizations a means of new friends. As you know, I see **Eli Berman** frequently. He is an amazing guy. He has gone to Arizona for a few months, and I presume you will hear from him."

We note the passing of **Morton A. Smith** in December 1987. Morton was owner/operator of the Radio Shop in Great Barrington, Mass., from 1926-1966, when he moved the shop to his home. He had been repairing small appliances until just a few months prior to his death. He was a 66-year member of Monument chapter, Royal Arch Masons, in which he served as a high priest and past secretary, and was a 67-year member and past master of Cincinnatus Lodge, AF&AM. Smith was a longtime member of the Great Barrington Rotary Club, receiving a 50-year perfect attendance pin and the Paul Harris Fellow award. His wife Marguerite passed away in 1974. He is survived by a daughter, two granddaughters, and two great-grandchildren.

We report with sadness the death of **Sumner K. Wiley** on December 9, 1987. Through the kindness of his daughter, Barbara Wiley White, I have a letter from Sumner written in January 1980. Rather than summarizing the newspaper death notices, here are some excerpts from the 1980 letter addressed to me:

"While a student, I lived at home in Somerville and commuted every day. I became a member of Lambda Chi Alpha, but my closest friends were from the small group of students in the Department of Architecture and Architectural Engineering, based then in the Rogers Building near Trinity Church. Contact with good men from M.I.T. meant much to me. It probably was very important, too, in finding those first jobs.

"Fresh from the army after World War I, I found an opportunity with General Electric, Schenectady, N.Y., in their Plant Engineering Department. Later in New York City, I worked with the architectural draftsmen and structural engineers in the architectural firm that designed our M.I.T. library.

"After a few more busy years, I wound up with the Federal Public Housing Authority as a regional director for New England in Boston and later in New York City, then Philadelphia. I approved the appointment of a lot of people for government service as well as the plans for and construction of a lot of housing."

About M.I.T., Sumner wrote, "To me M.I.T. has always been 'par excellence,' and the years have not changed this opinion although I have sometimes wished that more cultural studies might be available to undergraduates on an optional basis."—**Max Seltzer,** Secretary, 865 Central Ave., Needham, MA 02192; **Leonard I. Levine,** Assistant Secretary, 519 Washington St., Brookline, MA 02146

19

At our 65th reunion, the attending members voted unanimously for a 70th reunion for the class of 1919 in January 1989. Recently, we discussed the matter by telephone with **George Michelson, Doc Flynn,** and **Don Way** and proposed presenting a plan to the class with special appeal to classmates living close enough to the institute to make travel simpler. They thought well of the plan, and we will be sending out special notices to all class members.

While our class notes are scarce at this time, we do not have any bad news to send you. We were very pleased to talk to the classmates mentioned above and found them in good fettle. You now have a fine summer ahead, and we hope you can enjoy it. Meantime, we will write you concerning plans for our 70-year reunion.—**W.O. Langille,** Secretary, P.O. Box 144, Gladstone, NJ 07934, (201) 234-0690

21

The only class news I have this month is of the death of **Donald B. McGuire** on December 27, 1987, at a Yarmouth, Maine, nursing home. Don attended Rensselaer Polytechnic Institute and graduated with our M.I.T. class of 1921. He spent his career in the electric utility business and at the time of retirement was chief engineer of Orange and Rockland Utilities in Pearl River, N.Y. Don lived in Middletown, N.Y., for 27 years before moving to Brewster, Mass., and later, Harwichport.

The information above came from two sources: Alumni Records and assistant secretary **Sam Lunden.** Sam wrote: "During my last two summers on Cape Cod, Don and I have gone to the Orleans Men's Club together and to the summer outing of the Cape Cod M.I.T. Club. Last fall I visited Don in his Harwichport apartment, and Don told me he was moving to Maine to be near his son." Sam sent me a photo of a luncheon group, which included himself, Don, and **Whitney Wetherell.**—**Sumner Hawyard,** Secretary, Wellspring House E64, Wash. Ave. Ext., Albany, NY 11203; **Samuel E. Lunden,** Assistant Secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

22

In the class notes in the April *Review* I reported briefly on the death of **William C. "Bill" Gray.** I now have more information about his career, which was given me by Mrs. Alice Harris, his executrix, and one of his several nieces.

The cause of death was an accidental fall from one of the third floor windows of his home in Amesbury. His obituary appearing in the *Newburyport News* of June 25 states that he worked for Gray and Davis Co. of Amesbury, Tyer Rubber Co. of Andover, Nashua Gum and Coated Paper

Co. of Nashua, N.H., Lincolnfield Mills of Boston and Lincoln, Maine, the Merrimack Hat Corp. of Amesbury, the Bailey Co. of Amesbury, and at Peter Gray and Sons of Cambridge. Bill was a veteran of both world wars serving in the latter as a lieutenant commander in the navy.

At Tech he was a member of the Beaver, Walker Club, Masque, and was in the Tech Show ballet. During his career, he had many outside activities. He was chapter chairman, director, and officer of the American Red Cross, vestryman and choir member of St. James Episcopal Church, precinct representative in Amesbury for many years, member of the Newburyport Camera Club, American Society for Testing Materials, Amesbury Golf and Country Club, and the Nashua Country Club. Bill was a widower, his wife, Helen C. Lancaster, having died 12 years ago. He is survived by two half brothers and seven nieces.

Another classmate, **Royal A. Stone,** age 89, long active in alumni affairs died in Clearwater, Fla., on July 28, 1987. Roy had been in declining health for some time, which precluded his coming to our 65th. Marian, Roy's wife, who you will remember attended all reunions with Roy, had been kind enough to write me about Roy and his feeling of deep regret in missing the reunion last June. Then, in December, I got the most unwelcome news that Marian had died on November 28, 1987, four months to the day from Roy's death. After moving to Florida, "Stoney," as we knew him at the Tute, served as president and director of the M.I.T. Tampa Bay Club. On his trip to foreign countries, he always made it a point to look up classmates who might be living at his ports of call.

All M.I.T. alumni and the student body must have been delighted with the news in January that **Horace McCurdy** had given the Institute $500,000 for the establishment of a chair for crew. This would be similar to the academic chairs. As far as "Mac" was aware at the time, this is the first chair of its kind in the country. I hope we all live long enough to see the desired results from the generosity of the 1922 captain of the first varsity crew.—**Yardley Chittick,** Secretary, Box 390, Ossipee, NH 03864

23 65th Reunion

William Greenough, Jr. died November 25, 1987. He graduated with our class in aeronautical engineering. After graduation he joined the staff of the Physics Department at M.I.T. then in turn joined the Texas Salt Co., W. H. Coburn Co., and Greenough and Gifford. He later was sales manager, then assistant treasurer, vice-president, president and director of Whittet Higgins Co. He was also director of Skyways and Barrington Brick Co.; a member of the New England Council Aviation Committee, Providence Art Committee, and University Club; board of directors of Mary C. Wheeler School; and president of the M.I.T. Club of Rhode Island.

Philip Pearson died June 10, 1987. He graduated with our class in mining engineering. After graduation he joined Arthur D. Little, Inc. and became instrument engineer, later manager of control valve sales, specializing in hydraulics, metallurgy, design and application of valves and regulations. He retired in 1965.—**Richard H. Frazier,** Secretary/Treasurer, 7 Summit Ave., Winchester, MA 01890

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Mark L. Sinnicks, born in San Francisco in 1902, died last November, according to his daughter, Mrs. Clayton Del Secco of Atherton, Calif. He received his S.B. in chemical engineering. His start brings back early Western history, since he started his career running smelting mills in northern California. He retired 20 years ago when he was in charge of public works for all outlying naval air stations in the 12th Naval District. A letter of commendation from the commander of that district cited him for his achievements in monetary savings in procurement and for developing specifications for an important electric generator. Diverse areas for a chemical engineer! His retirement years were spent in Santa Rosa Calif. He attended the 50th and 60th reunions of our class.

Arthur J. Kemp, who died in December 1987, was born in Chicago just before the turn of the century. He was a transfer from California Institute of Technology. He had had two and one-half years in the navy in World War I. After only one year at M.I.T., when he was elected class president, he had to drop out and go to work. Perhaps his skill in photography got him into advertising, first with Honig Copper Co., then with the *Los Angeles Examiner.* There he got into broadcasting, which took him to New York City and the Columbia Broadcasting System. He became vice-president and group head of the large advertising firm of McCann Erickson, Inc. and finally retired to Laguna Hills, Calif.

Willard W. Van Allen of East Boothbay, N.Y., is reported to have died there in December at age 84. He graduated from the Phillips Exeter Academy before attending M.I.T. to get his S.B. He became a teacher of science and mathematics in public and private secondary schools and a research physicist with U.S. Public Health Service. He had papers published on radiology and electronics.—**Rockwell Hereford,** Box 5397, Carmel, CA 93921

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Two years from now the class will be observing its 65th anniversary. Your secretary has talked by phone with **Sam Spiker** and **Courtenay Worthington,** and we would like to have some ideas from classmates as to what you would like to do to celebrate. Don't be hesitant—send your ideas on to me.

Nicholas Draim writes that on July 2, 1987, his wife of 62 years, Marie, died at the Navy Hospital in Bethesda, Md. He states that his health is going down rapidly. He is now residing in Apartment 810, Area D, of Menno Village, Chambersburg, Pa. The village is a health care center run by the Mennonites.

It is with sorrow that the deaths of two classmates must be reported. **Harold E. West** died on December 21, 1987, at the Old Saybrook Convalescent Hospital in Connecticut. Harold was employed by AT&T in New York and became project manager for the Long Lines Division. He retired in 1967 and moved to Essex, Conn. He is survived by his wife, Margaret O'Neil West, two sons, a daughter, and five grandchildren.

Robert L. Dietzold died of cardiac arrest on November 10, 1987, at his home in Summit, N.J. After leaving M.I.T., Bob studied at Yale, Corpus Christi College of Oxford, and Columbia. From 1930-1964, he was with Bell Telephone Laboratories involved with mathematical research and network theory, where he became director of Military Systems Studies. He was one of the major engineering architects of the Telstar satellite, which was sent into orbit in 1962. Bob was also a professor of mathematics at the Polytechnic Institute of Brooklyn. He was married to Dr. Frances Clark, '22, who died in 1983. Those of you who took chemical courses will remember Dr. Clark, who was on the Chemistry Department teaching staff from 1922-26. Bob is survived by two nieces and a nephew.—**F. Leroy "Doc" Foster,** Secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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You have already read about (in the April 1988 issue of the *Review)* the great loss last January 29 of our famous classmate, **James R. Killian, Jr.** As president of M.I.T. from 1949 until 1950, then chairman of the Corporation until 1971, he is credited with leading the institute to worldwide preeminence in research and education in science and technology.

In 1957, Jim became the first full-time science advisor to a U.S. President, when Dwight D. Eisenhower named him his special assistant for science and technology. During a 60-year career dedicated to addressing the social impact of science and technology, he was instrumental in establishing public radio and television, advising the creation of the National Aeronautics and Space Administration (NASA), and shaping the science and technology that became the basis of America's post-World War II strategic defenses.

More recently (late last year), Jim was honored by the Charles A. Dana Foundation with a Special Dana Award (See *Technology Review,* February/March 1988, p. MIT 14.)

A close friend of mine, who became an admiral, told me of going to various colleges to get research done for NASA in the early fifties and the efficient way Jim took care of the assignment for M.I.T. There will be a memorial on Technology Day and an institute memorial service at 2:30 on May 5.

George F. "Ted" Brousseau, who lives in Braintree, as I do, lost his wife five years ago, but never remarried. He says it is very lonesome, as I am sure it is. Years ago Ted and I were contract bridge players for our club and also entered area bridge tournaments. No more. I guess Ted isn't quite alone. He and Bertha had one son and one daughter. He now has 11 grandchildren, and eleven great-grandchildren living nearby. Is this a record for the class?

Robert C. Dean hasn't retired yet. He is chairman of the board of the large architectural firm of Perry, Dean, Rogers and Partners of Boston. His firm just won the most prestigious award in the nation, the 1987 Harleston Parker Medal, for the Wellesley Science Center. Since 1923 the Boston Society of Architects has presented this award for "the most beautiful piece of architecture within the limit of the city of Boston or the Metropolitan Park District."

Walter E. Lobo of New Cannan, Conn., lost his wife Kathleen on March 6, 1987, of Alzheimer's disease. This is a terrible way to go.

Opposite page 41 of the January issue of *Technology Review,* you will see a "Donors' Profile" of Mr. and Mrs. **Millard M. Greer** having made a "gift of capital." In addition to an outline of his career is an outline of benefits to be given by our pooled income funds.—**Donald S. Cunningham,** Secretary, 27 Lowell St., Braintree, MA 02184

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We have a note from **Joseph S. Yates** of Wyandotte, Mich., that for some unknown reason his name was dropped off the class mailing list. His brother, Dick, '31, sent the picture of our 60th reunion group in Marblehead last year. It was Joe's first word of our reunion for lack of receiving any of our letters. The picture reminded Joe of a dinner at the Eastern Yacht Club in 1925 with **Bob Hancock** as the guest of the vice-president of Stone & Webster. We will see that Joe is put back with the living. Our apologies!

A year ago, **Nathan Cohn** presented a paper in Montreal on the 60th anniversary of the first installation of Automatic Generation Control. It was at the Harriman Hydro-Power Station on the Fairfield River in Vermont. He showed photos of half a dozen early pioneer inventors, starting with Morris Leeds, who held a patent on electrical recorders in 1910 and 1915. Nat, who himself contributed largely to today's sophisticated inter-area electric power control, gave tribute to those early inventors. He refers to them as representative of the cooperative effort of "those from utilities, manufacturers, academia, and consulting groups whose contributions have added to the continuity, growth, and expanded technology of our discipline over the past 60 years." Nat closed with a universal challenge to all engineers: "Innovations

permit horizons to be approached. They serve best when, in the process, new, more distant horizons are revealed, urging innovators onward, so that continuity can be not only sustained, but be dynamically progressive."

Your secretary, for one, firmly believes that the production, distribution, and usage of electricity has been the greatest contribution to change in the world during our past 60 years.—**Joseph C. Burley,** Secretary, RFD, Epping, NH 03242; **Lawrence B. Grew,** Assistant Secretary, 21 Yowago Ave., Branford, CT 06405

28 60th Reunion

As these notes are being written it is mid-February and our big '28 60th reunion is still almost four months away. Yet even at this early date, all indications are for a very large and enthusiastic attendance. **Abe Woolf** and his committee appear to have surprised even themselves! When you receive these notes there will still be several weeks before the great event. If you have been holding off or hesitating on your decision to attend, you still have time to join us. Send or call in your reservation, get out your old red jacket, pack up, and come! On arrival you will be welcomed by the hospitality committee that includes Frannie **Donovan,** Dorothy **Goldberg,** Marjorie **Carvalho,** Bettie **Day,** Alice **Decorte,** Mary **Nichols,** and Jo **Shiepe.**

Not surprisingly, a number of notes and messages have arrived with the various mail return forms: **Harlan Paige** was one of the earliest registrants and graciously offered to help when he arrives—he has our thanks and grateful acceptance. . . . **Bob Hunn** says that he is bringing a son and grandson to the reunion as his guests. . . . **Sid Brown** reports that his bypass surgery of last year has made him a new man. After becoming widowed several years ago, Sid remarried. He and his bride will be at the 60th. . . . Anne and **George Palo** write to tell us of a rugged two weeks of midwinter snows and -15° F. temperatures in Rochester, Minn. They, too, are looking forward to the joy and events of June 1-5.

Our class seems to be having its full share of heart cases. **Ben Draper** is recovering from a recent hospital stay and operation for an aortic aneurism. (We have sent him get-well wishes.) . . . **Henry "Nap" LaCroix** also had a serious aortic aneurism operation at almost the same time as Ben. He is hoping to be recovered by June 1 so he can make the trip to Cambridge. (He also has our get-well wishes.)

Registering for reunion, **Eleanor Pepper** writes: "I am looking forward with great anticipation to seeing some of my classmates. I am working hard as ever and enjoying life." . . . **Jean (Brand) Bennedsen** will definitely attend with her husband, Ben, and they might even bring a guest. . . . **George Mangurian** says they plan to move soon into a condominium in Silver Spring, Md. This will locate him nearer to his older son, who lives in Bethesda. Apparently George still has lots of vigor—he lists golf and swimming among his continuing interests.

We extend our deep sympathy to **Jack Rouleau** whose wife, Alice, died December 14, 1987. They had a wonderful life together for nearly 59 years. She loved to travel and they visited 24 countries together, living in France for four years and in Canada for two. Jack's family now consists of two sons, a daughter, ten grandchildren, and four great-grandchildren. You will see him in Cambridge on June 1.

Regretfully, we have an unusual number of classmate deaths to report: **D. Thurber Bridges** died December 21, 1987. The information was provided by his daughter to the Alumni Office. Thurber was in Course XIV, electrochemical engineering, and, according to our records, was with Barber Colman Co. in Framingham, Mass., during his earlier years. . . . **Kenneth G. Gove** died January 14, 1988. Kenneth, a graduate in Course IV-B, general engineering, had been an engineer with RCA and was a World War II navy veteran. His wife, Elizabeth, wrote that they had 61 years of married life together. . . . **Frits Malschaert** died in April 1987. This information came to us from his wife, Margaret, in Ghent, Belgium. Frits earned his S.M. degree in Course XVI, aeronautical engineering, and was a professor of automotive engineering at Ghent State University during his active career. . . . **F. Kenneth Miller** died August 2, 1987. We were informed of this via the response card of a class mailing. Kenneth was from Course II, mechanical engineering, and his professional career was with several prominent companies in the automotive tire and rubber industry.

William P. Rothwell died January 28. Again, the information came to us by way of a reunion response card. William joined the class in his senior year and graduated in Course XV, business and engineering administration. He was a business management consultant. . . . **William E. Shenk** died January 4. Bill graduated in Course VI, electrical engineering, then continued on to his master's degree. His life work was in engineering and engineering administration with a sequence of several prominent manufacturing companies. Bill and wife, Priscilla, attended the 55th class reunion in 1983 and had been looking forward to the 60th. . . . To the families of these departed classmates we extend our heartfelt sympathy.—**Walter J. Smith,** 37 Dix St., Winchester, MA 01890

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Everett P. Weatherly, Jr., of Shawnee Mission, Kans., sent a brief note stating that he retired from a construction company 20 years ago. He and his wife Marion are in good health and enjoy traveling. They play bridge and tennis.

Harold W. Straat of Rochester, N.Y. writes, "With this birthday I have joined the club and have become an octogenerian. My wife Marcelline and I are both in good health and active. We maintain our home here in Rochester and have a summer home on Lake Keuka. I have been retired since 1972, though I continued doing consulting work for 12 more years. Now I keep busy enjoying life and look back with fond memories of many friends and classmates from M.I.T."

John Happel of Hastings-on-Hudson, president of Catalysis Research Corp. and special research associate at Columbia University's School of Engineering and Applied Science, was named a recipient of the 1987 Founders' Award given by the American Institute of Chemical Engineers at the institute's annual meeting in November 1987. He was honored for "innovative industrial and educational contributions spanning more than 50 years." His research efforts have been in fluid-particle systems, catalysis, and chemical process economics. The results of this work are documented in the 130 papers and eight books which he either authored or co-authored, and he holds 30 patents for his technical innovations.

Your secretary would like to share with you a bit of good news about his health problem. My left (good) eye that was damaged in a bicycle/car accident in October 1985 causing pressure up to dangerous levels had been under treatment and in stable condition for over a year. Last spring when I returned from Florida, I went to my ophthalmologist for a periodic check up. He was disappointed to see the pressure up again. For several months he continued the treatment to control the pressure without success. He informed me that the only option left was to have a regular surgery, which had an element of risk. The alternative would be total blindness. I had the operation on September 3, 1987, and I am happy to report that it was successful. Now I am able to see better than before the operation but not quite as good as before the accident. I can drive during daylight hours, and my wife Helen does the driving at night.

In the February/March 1988 issue of the *Review,* I reported the death of **Romeo H. Guest** of West End, N.C., at which time I had no background information to report. Fortunately, I received a note and a newspaper clipping from **Butler King Couper** of Tryon, N.C., as follows: "Not having seen Romeo H. Guest's death notice and obituary, I thought perhaps I had missed it. The enclosed write-up about his death shows that he was a classmate that we should admire. He was my fraternity brother, and I knew him well. He established the Research Triangle Park in North Carolina influenced partially by the powerful combination of universities, research, and industry near M.I.T. where Harvard, M.I.T., Arthur D. Little, and large industries in Kendall Square were all grouped in Cambridge, Mass." Guest was known as an aggressive industrialist recruiter for North and South Carolina and the Southeast. He was a very private philanthropist. He wanted to get industries to North Carolina because it needed them for its labor force. "He would try for North Carolina, then put them in South Carolina, his home state," said Pat Nelson, his longtime secretary. Nelson and Guest worked together with towns throughout the Southeast and got towns to build roads, water, sewer, and drainage systems. He would locate a site for a plant, build it, get all the equipment, and start it up for them. Company records indicate that Romeo Guest Associates in Greensboro handled projects for 40 companies listed in *Fortune Magazine*'s top 500 industrial companies. Guest retired as chief executive of the firm in 1976.

I regret to report the deaths of the following members of our class: **Ludwig C. Hoffmann** of McLean, Va., in 1985; **Daniel J. Collins** of Whiting, N.J., on March 19, 1987; **Joel M. Whitney** of Santa Rosa, Calif., on November 23, 1987; **John F. Joyce** of Drexel Hill, Pa., on November 24, 1987; and **Stephen N. Dilworth** of New Port Richey, Fla., on January 20, 1988.

I received a note from Rosemary Collins, daughter of **Daniel J. Collins:** "On March 19, 1987, a truck hit my parents' car near where they lived. My father died instantly, but my mother died on June 9, 1987, still in intensive care."

Mary, wife of **John F. Joyce** sent me a note: "I regret to say that John passed away on November 24, 1987. He had been ill for a year with cancer and had major surgery in October 1986. Although he had no pain, he never gained his normal strength back. Finally, just a year later, he was hospitalized for 39 days and faded away peacefully. John established a business in 1947 of buying and selling industrial electrical equipment and supplies for public utilities and other industries. He worked hard at it but loved his work. Like any new business, it was very difficult at first, but he persevered and believed that his engineering training would help him to achieve success. He always referred to transformers as though they were his friends. Someone asked him once, 'Why are you working so hard; why don't you retire and enjoy life.' His reply: 'What I am doing is enjoyment not work.' We have two sons and two daughters, and we are very proud of them. We also have 11 grandchildren. During John's illness, I don't know what I would have done without the help, devotion, and love that our children gave to both of us." John and Mary were very active in class and M.I.T. affairs, having attended most of the major reunions including the 30th, 35th, 40th, 50th, and 55th.

Stephen Dilworth's wife Myn sent me a note announcing his death. This brings back some fond memories of our 45th reunion on the Cape. Stephen brought a friend with him and let it be known that he had asked her to marry him, but she was on the fence. Every '29er at the reunion joined the chorus encouraging her to accept his proposal. They were married a few months after the reunion. Stephen worked before his retirement for the Aluminum Co. of America in Edgewater, N.J,. as an engineer, vice-president, and secretary.—**Karnig S. Dinjian,** Secretary, P.O. Box 83, Arlington, MA 02174, (617) 643-8364

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It is always pleasant to be able to report that a number of our classmates are not only in good health, but are vigorously pursuing post-retirement careers. As previously reported, after spending 40 years working on R&D problems of the chromium chemicals industry and then teaching at Belmont Abbey College, **Win Hartford** has in recent years spent much time speaking, writing, and working with committees on a variety of health and enviromental problems. In his latest letter, Win notes that in 1986 he gave the keynote address at an International Industrial Hygiene Foundation symposium on chromium in Washington, D.C. Last year he gave a paper before the International Research Group on Wood Preservation in Ontario, Canada. He has also been working for the International Executive Service Corp., which in February-March 1987 sent him to Bombay, India, to improve the efficiency of an ancient chromium-processing plant. At the time he wrote, Win was planning to return to Bombay this year, with a stop to visit some Turkish facilities en route. Win says that the developing countries "are beginning to become aware of possible health and environmental problems—although they are completely overwhelmed by the problems of human environment in cities like Bombay." . . . **Les Steffens** keeps busy in a number of areas. He has been "acting in a children's theater, doing some 20 or 30 performances a year of fairy tales such as *Cinderella*. The performances are in grade schools. We move our set and considerable impedimenta in a rental truck, from school to school, with the kids helping unload and load. I even got to do a female part." Les is also training at the Greenwich Audubon Center to be a docent for visiting school groups. In addition, he has recently taped a 700-page text on economics for a blind student, as well as an anatomy lab text book with descriptions of all plates and diagrams. Last summer he drove 13,000 miles visiting national parks, spending two weeks at an Audubon camp in Wyoming and another two weeks observing and counting killer whales on the Pacific coast near the Canadian border. At the time he wrote, Les was again planning to race in the Sunfish Regatta in Venezuela in February.

Unfortunately we have a larger than usual number of downbeat items this month, including the deaths last year of Schuyler Pyne on June 13, Arthur Heifetz on November 12, Edgar Hawkins on November 26, and Amerst "Ed" Huson on Christmas day. **Schuyler Pyne** was a Naval Academy graduate who received an S.M. in naval architecture from M.I.T. in 1930. Thereafter he had a distinguished naval career as a designer of auxiliary ships and landing craft for the Bureau of Ships during World War II, manager of the naval base in Guam, naval engineer officer of the U.S. Mission for Aid to Turkey, commander of the Pearl Harbor Naval Shipyard in 1954, and before his retirement in 1961, commander of the N.Y. Naval Shipyard in Brooklyn. He is survived by his wife, Jane, three children, and eight grandchildren. . . . **Arthur Heifetz** lived in Andover, Mass., for 50 years. He was a veteran of World War II and served from June 1941 to January 1946 as medical inspector with the 87th infantry. At war's end he was a lieutenant-colonel as well as the recipient of a Bronze Star and other decorations. For most of his career he owned and operated the Andover Finance Co., a finance and loan firm for individuals and small businesses. He was very active in church-related affairs, serving as president of Temple Emmanuel for two years and its treasurer for 20 years, chairman of the Greater Lawrence United Jewish Appeal, and president of the Lawrence Jewish Community Council. He is survived by his wife, Beatrice, three children, and six grandchildren. . . . **Ed Hawkins** was one of the first Sloan Fellows at M.I.T. Except for a World War II interlude as a lieutenant-commander with the Seabees in the Pacific, he spent his career in public-utility management, beginning as a district superintendent with Virginia Power. He later held positions as executive vice-president of Michigan Gas Utilities Co., president of Jamaica Public Service Ltd. of Montreal, senior vice-president of Stone & Webster, and president of Southeastern Utilities Co. of Atlanta. At the time of his death, he and his wife, Carol, were living in Petersburg, Va. In addition to Carol, he is survived by a daughter and two sons. . . . **Ed Huson,** like Ed Hawkins, was an early Sloan Fellow. During World War II he was on active duty from 1941 to December 1945, and rose to the rank of commander. During this period he served as investigator for the House Naval Affairs Committee, whose chairman was Lyndon Johnson and from whom he received a letter of commendation for extraordinary efficiency. Ed spent most of his career working for the S.E.C. in Washington, D.C., and retired as special advisor on public utilities. After retirement he pursued his antique-clock hobby. He collected, restored, and studied the history of old American clocks, as well as writing and lecturing extensively on the subject. For many years he was treasurer of the National Association of Watch and Clock Collectors Inc., an organization with more than 30,000 members. He was also active in Masonic work. Ed's wife, Margaret, died only a week before him. He is survived by a daughter and two grandchildren.

Regular "reunioners" of the class of '30 will recall that in recent years our classmate **Ching Yang** and his wife, Sally, came from China to attend our 45th and 50th reunions. We have now received a note from son Peter Yang, '60, that his mother died in Shanghai on December 13, 1987.—**Gordon K. Lister,** Secretary, 294-B Heritage Village, Southbury, CT 06488

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A note from **Dick Ashenden, Jr.,** says, "We went to Norway and took the coastal ship from Bergen around North Cape and returned in June 1987. Peg and I have been meeting with Louise and **John Swanton** to plan our 60th in 1991." . . . Another note from **A. Harry Wagner** says, "Made final retirement in June 1986 as executive secretary, Virginia Concrete Masonry Association. Continuing to visit children around the country, and travel wherever the best trip comes to light."

Regret to report the following deaths of our classmates. **Eugene J. Lourie** passed away on May 27, 1987. His home address is given as 1543 Dorcester, Birmingham, MI 48008. . . . **Frank C. Gallagher** died on December 24, 1987. His home address is given as P.O. Box 451, Marshfield, MA 03050. A clipping says that "Frank C. Gallagher, 85, of Marshfield, a retired MBTA supervisor, died Thursday at Newfield House, Plymouth, after a long illness. Born in Cambridge, Mr. Gallagher was a graduate of Chauncy Hall School and a 1931 graduate of the Massachusetts Institute of Technology." . . . **Byron Martin** passed away on December 12, 1987. His home address is given as 15 Cassidy Ave., South Dennis, MA 02660. Our sincere condolences to their families. . . . Another death has been reported, namely: **Charles Ernest Loucks** on December 19, 1987.

John H. Dodge says, "Still busy—working on seventh edition of *PSSC Physics* and teaching advanced-placement physics in two of the local high schools. Teaching teachers in the summer. Bicycle riding here in Florida, in the northeastern mountains, and Colorado. . . . **Albert Sims,** whose new zip code is 34223, writes, "**Sam Burrow** and wife, Kay, '32, now live nearby, so we manage more faithful attendance at the M.I.T. Club of Southwest Florida." . . . **Leonard A. Schuttis,** whose address is Box 1451, Annapolis, MD 21404, writes, "Still playing some jazz piano as I did with **Roy Ide** in the 1931 Tech show, which was managed by "Deaf" Gardner '32. Living in an adult community complete with golf, pool, billiards, etc. Just turned 81. In good health. Just had hip replacement. Will spend winter in Manila with son."—**Edwin S. Worden,** Secretary, P.O. Box 1241, Mount Dora, FL 32757; **John Swanton,** Assistant Secretary, 27 George St., Newton, MA 02158

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Doris writes us the sad news that her husband **Donald B. Gilman** died suddenly on December 14, 1987. She says he wanted to go to our reunions.

On the day of our 50th, he was being released from the Deaconness Hospital after 14 weeks of hospitalization and at the 55th, they were moving from the country to their "downtown" apartment in Peterborough. Doris writes, "For the last six months he enjoyed being able to work around town, a familiar figure in his beret and his cane. The week before he died was particularly happy, as we celebrated his 77th birthday, our 53rd wedding anniversary, and enjoyed a luncheon with his former associates at Warren Pump, Inc."

Besides his wife, Donald leaves a son, a daughter, and five grandsons. He has written a fascinating autobiography for these boys. Don had recently completed a book, *Headlines of History,* complete with 74 maps and 67 illustrations of his own drawings. "Don always had a most active mind, a cheerful disposition, and a great sense of humor. Life with Don was never dull nor boring," says Doris.

I am sure that Donald Gilman was widely known and liked by his classmates. He was our class president in our third and fourth years as well as many years after graduation. Our class sympathy to you, Doris. My thanks to you for your informative letter. I did not try to cover his career and general honors which many of us know anyway.

Ernst Harold Anderson has been retired from electrical contracting since 1971. He is active in the Baptist Mission of North America. His wife Jane passed away in August 1987 after "52 wonderful years of married life."

We have been informed that Dr. **George Murray** died in November 1987. He was a research chemist at the U.S. Army Materials Command. He is survived by his wife Florence.

I received a nice New Year's card from Eleanor and **Bill Bannon.** They enjoyed our 55th reunion and the Cardinal and Gray meetings. They say, "We are very busy watching our four grandchildren sprout up like weeds."

Harry Summer ('33, started as '32) writes me that our classmate **Lester Glickman** died in October 1987 of a bad heart and cancer. He was with the navy most of his professional life as a civilian engineer specializing in explosives. He participated in the test firing of the H bomb.

We are sorry to learn that **Adolph Warsher** has had a heart attack and had to retire from his work at Mitre. Best wishes for a good recovery and more good active years for you.

Dr. **Rolf Eliassen** and wife Mary are well and active. Rolf, write me a long letter about your present interests (or past) and activities. Your classmates will be most interested.

Thomas Weston sent me the obituary of our classmate **George H. Sistare.** He died at home unexpectedly on December 30, 1987. George spent 40 years as a research metallurgist. He was a consultant for Handy and Harmon until he retired in 1975. George was a bachelor and active in many professional organizations and the Fairfield Yacht Club.

Tom Weston remembers him well from college days. He was a "quiet and brilliant guy—just a guy you were proud to have as a friend." Tom recalled when Lipton came to challenge the U.S. for the Cup (the fifth and last time). George invited him to watch the race from George's family sailboat. Tom and his wife Rose will be celebrating their 40th anniversary on a Caribbean cruise. Tom also says he hopes the '32 gang will get together before the 60th. He's found another verse to "Black Socks."

Willard A. Meyer drops us a short note. He

has been retired since 1972. He lists his hobbies: boating, fishing, local politics, investment management, and grandchildren admirement.

Robert Follansbee sends us the following note: "Sue and I skim the best from two locations: summers, South Portland, Maine; winters, Venice, Fla. We enjoy the alumni groups in each area and had a great time at our 55th at dear old Tech."

Keep writing me.—**Melvin Castleman,** Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

33 55th Reunion

Apparently surviving class members are saving recent memorable experiences for the June reunion. Not a word from anyone since last report—except melancholy news of losses.

Bill Conant's death occurred September 20 last. Widow, Mrs. Theo M. lives at 1004 Barley Mill Rd., Wilmington, DE 19807. . . . **Dick Hodgdon** died November 15, and leaves his wife Harriet who lives at 5 Eustis Ave., Wakefield, MA 01880.

Dick Fossatt reports that he and Charalee had a pleasant visit with Harriet and Dick on October 9 in Wakefield and that Dick seemed then in excellent health. . . . **Mrs. S. H. Walters'** memory was honored last June by the planting of a pin oak tree at the Cheshire Medical Center in Keene, N.H., with a granite block at its foot inscribed "In Memory of Dorothy L. Walters." She was board chairman.

Fred Murphy, Burt Webster and **Dick Morse** are fine tuning our 55th at Cambridge/Chatham Bars June 2-5. For any query, phone Eliza Dame at Alumni Office, (617) 253-8230. See you there!—**William B. Klee,** Secretary, P.O. Box 7725, Hilton Head, SC 29938

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Correction: In the November/December '87 issue I wrote that **Lester Moffatt's** son Hugh had signed as a singer with Milo Records. It should be listed as Philo Records, nationally distributed by Rounder Records of 1 Camp St., Cambridge, MA 02140. . . . Here's the latest news on **Art Haskin's** Tanzer 22 sailboat, *Surefire.* "Planned improvements included a lighter and better-shaped rudder, some weight redistribution, and elimination of other negative factors. *Surefire* responded with enough better boat speed to take first place in both the July and August handicap series, and to improve her position in both the Casco Bay Interclub Regatta and the State of Maine Tanzer 22 Championships from eighth and fifth last year to third and fourth this year. Both of these regattas were held in heavy weather, so we have some work to do next year to learn how to handle the heavy stuff better. We did, however, light off the afterburner in the last race of the State of Maine and led the fleet to the last turning mark, but then rounded the mark on the wrong side. There were rumbles about eliminating the last negative factor, the helmsman, but so much for democracy—he gets the one and only vote. Son Dan did most of the committee work for these series and regattas, and did his usual superb job." Daughter Carolyn and husband Wayne Roth spent a week in Maine last summer. Carolyn still teaches third grade in Nederland, Colo., an 8-mile commute over the mountains from their home in Boulder. Wayne has a new job in Boulder in industrial piping design and engineering. . . . Marjorie and **Bill Parker** write from Bella Vista, Ariz.: "We have had no real big adventures or misadventures. Our travels revolved around family. Once again we were in Wellfleet on the Cape for the month of June, where we shared the smell and sounds of the ocean, the sight of the waves and sailboats, and the taste of good fresh fish with family. We can't say which of our children is the busiest—Ellen, Sue, or Tom. They are all on a fast track, commuting too many miles to work or chauffering their children."

I went through a couple of deadlines before putting this in the notes because I was hoping my acknowledgement letter to **Betty Haskins** might produce more information about herself. She had written to me enclosing a gift to M.I.T. to go through our class. She wrote, "I do feel I owe M.I.T. much, and I look back on my years there with pleasure. I do read your notes with interest but the few close friends I made in those days apparently never write to you. Life continues interesting to me and has brought many compensations, such as increased objectivity and the longer-range point of view, a feeling of more freedom intellectually, much less pressure." If you are one of the few close friends, please get out your word processor and send me a note that I can pass along to Betty Haskins through these notes.

Eleanor M. Germond, widow of **Paul Germond** who died June 15, 1984, sent me a generous gift to M.I.T. through our class in memory of Paul.

One thing about the class of 1935 Annual Golf Tourney—it sure produced a pile of correspondence full of interesting information for these notes. It was something that brought a great many members of this class closer together, and it went on for 25 years—from our 25th to our 50th. Two years without those contacts have made me realize what a special thing we had going. I miss you guys. Can't some of us get together and have a day of golf this season? I have a message unit on my home phone—(617) 899-0358—so call and let me know how you feel about it.

I am sorry to report the death of **Fred M. Kraus** on December 11, 1987, of complications following a heart attack in Stamford, Conn. Born in 1913 in Regensburg, Germany, he immigrated to the U.S. in 1925. He earned his bachelor's and master's degrees in Course X. After several years at Lummus/Combustion Engineering he joined the Kellner and Livingston real-estate management firm, becoming a partner and secretary. Survivors include his wife, Shirley, sons Peter and Kenneth, daughter Katherine, and seven grandsons. We send our deepest sympathy to his family. Peter Kraus wrote to M.I.T. as follows: "Because of my father's continued interest in science and engineering, the family wishes to establish a scholarship in his memory. We would like to award a small scholarship to a worthy freshman who intends to gain a degree in chemical engineering. We'd prefer to limit this to a freshman from either New York State or Connecticut. We envision that we may donate around $5,000, and we thought that approximately $1,000 could be given annually to a freshman (who demonstrates financial need) for perhaps five consecutive years."—**Allan Q. Mowatt,** Secretary, P.O. Box 524 (3-120 Pond St., 02154), Waltham, MA 02254

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Ex-president **Tony Hittl** and Dottie motored from California to Pennsylvania last June for a family reunion and Dottie's 50th at Allegheny College, toured Mount Rushmore, Yellowstone, Bryce and Grand Canyons, then went back to Laguna Hills via Las Vegas. This spring they will take the Queen Elizabeth II from Los Angeles through the canal and Caribbean to New York and on to England, overland to Austria to visit daughter Barbara, then port-hopping by boat from Venice to Lisbon. Back home by plane June 7. That's a suitcaseful of traveling!

Assistant Secretary **Pat Patterson** received greetings with notes from fellow swimmer **Bill Hope** of Durham, N.H., and from Betty and **Art Sarvis** of Flint, Mich. Art was in Course II, and retired from General Electric, Cleveland Lamp Division, in 1976. On the telephone he sounds hale and hearty, playing golf and skiing in season. He made the 45th reunion but not the 50th, so we hope to see him at the 55th. **Ollie Angevine** sent Pat the "50 Years Ago" page from the December '87 *Scientific American* which contains the following gem: "It would be quite proper to call 1936 the squarest year because: 1936 is the square of 44, 1 is the square of 1, 9 is the square of 3, 36 is the square of 6, 16 the square of 4, 196 the square of 14, 361 the square of 19, 169 the square of 13, 961 the square of 31." Personally I think we are four-square in raising round figures for technology.

Page MIT 13 of January's *Technology Review* pictures **Bill Rousseau** in a group at the kick-off of Campaign for the Future. Bill came into Course X in 1934 after graduating A.B. from Stanford. Apparently he liked what he found in Cambridge, including Margaret Hutchinson '37—also a Course X graduate student (and the first woman to get a doctorate in chemical engineering at M.I.T.)—whom he married in 1939; the Badger Company, where he rose to vice-chairman of the board; and M.I.T., for which he has given and raised substantial sums from way back and has been a senior visiting lecturer since 1974. In the 50th reunion photo, he stands twelfth from the right in the back row. He reminds me of **Ed Nicholson, Mal Blanchard,** and other "short-timers," graduate and undergraduate, who have worked diligently for our glorious Institute, notwithstanding their relatively brief exposure as students. I do not know you all, so please, get your light from under a bushel by dropping a note to me or Pat.

A toast to the life of **Raymond Healy,** who died suddenly of a heart attack while walking with his wife, Elizabeth, last November 28, near their home at Lane Gate Rd., Cold Spring, NY 10516. They were just back from a long trip in Europe, and one day earlier had flown with their daughter while she gave flight instruction to Elizabeth. Ray was in Course XV and finished up at N.Y.U., was with Liggett & Myers, and then on Wall Street with Gordon B. Todd Co. After retirement he brokered real estate in Westchester County and kept active with swimming. Cheers for a full and active life of 75 years.

Phoebe and I are planning a trip to the East Coast on a southern route in April, and back via a northern route in late May or June. We are spotting my classmates, and hers of Bradford College, along the way on a road map, hoping to be near enough to see some of you. We are self-sufficient in our camper, and the beauty of such travel is that no reservations are necessary. We can adjust our plans from day to day, and by calling ahead, perhaps meet some classmates singly or in groups over coffee.—**Frank Phillips,** Secretary, 901 Los Lovatos, Santa Fe, NM 87501, (505) 988-2745; **James Patterson,** Assistant Secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

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Robert S. Childs of Palo Alto, Calif. was a project engineer with Bendix, Teterboro, N.J.; engineering manager at TRW, Cleveland, Ohio; and vice-president of Bunker Ramo Corp., Trumbell, Conn. He is now a financial consultant with Sherson Lehman Bros., Copertino, Calif. He married wife Margaret in 1944. . . . **Charles W. Dodge** of Golden, Colo., worked as a welding engineer for Chance Vought Aircraft in Conn. and Sciaky Bros. Inc. in Chicago, Ill., then as a staff engineer for Bell Aircraft Corp. in Niagara Falls, N.Y. In Denver, Colo., he was chief of laboratory at Stanley Aviation, systems engineer at Martin Marietta Corp., and chief engineer at Frost Engineering and Development Corp. He designed an automatic lapbelt buckle for aircraft ejection seats that is still being used in many air force fighters. Retired in 1984, he has been married to Eleanor for 48 years and is currently doing in-depth Bible study and research using an IBM PC. . . . **Davis Hamerstrom** of Roscroe, N.Y., married Elizabeth in 1942 and has been a self-employed architect for the past 32 years.

Daniel J. Hanlon, Jr. of Clearwater, Fla., was a patent attorney first in private practice and then

with Kimberly-Clark Corp. as a senior patent counsel in Neenah, Wis. He attended St. John's University School of Law, and was admitted to the practice of law in New York, Ohio, and Wisconsin, the United States Patent Office, and the United States Court of Military Appeals. He married Anne in 1942 and retired in 1980. His hobbies are golf, lawn bowling, wood carving, and swimming. . . . **Francis D. Houghton** lives in Vineyard Haven, Mass., with his wife, Elizajane. He worked for Du Pont in Wilmington, Del., and Deepwater, N.J.; was a research chemist for Sun Oil and American Viscose in Marcus Hook, Pa., and then chief scientist of Laboratories and Pesticides Surveillance with the New Hampshire Water Supply and Pollution Control Commission in Concord, N.H. Since retirement he has helped Vineyard Environmental Protection Inc. establish a water laboratory on Martha's Vineyard, where he works part-time supervising its operation.

Sydney Karofsky and his wife, Sylvia, live in Weston, Mass. (summer), and Key Largo, Fla. (winter). He was chief designer at Krokyn and Browne Architects before he founded and became chairman of the board of Northeastern Wallpaper Corp. of Boston and Walls Unlimited, Inc. (with branches in Hartford, Syracuse, and Philadelphia). He is a recipient of the Allman Award (the highest industry honor for wallcoverings), president of the National Association of Wallcoverings, and past vice-president of the National Association of Wholesalers. He was president of the M.I.T. Stein Club, the New England Wallpaper Association, and Hillel House at B.U., and a member of the Brookline Planning Commission and the Department of Commerce Industry Standards. He is now a member of Pine Brook Country Club, Weston, Mass; Ocean Reef Club and Harbor Club, Key Largo, Fla.; and enjoys playing golf, fishing, boating, photography, reading and sketching. He is a member of Copley Society—designated "Copley Artist"—which has group and one-man shows.

J. Edward Lynn of Old Greenwich, Conn., married Marianne Close in 1942. Between 1940 and 1955, he was assistant professor at Colloid Chemical Institute of Paper Chemicals, Appleton, Wis.; director of Textile and Surfactants Laboratories, American Cyanamid, Stamford, Conn., and director of Basic Research, National Gypsum, Buffalo, N.Y. Since then he has been a consultant to Textile and Allied Industries and self-employed. He has written and edited many technical books and articles, developed several textile and chemical patents, and is editorial director of *American Dyestuff Report*. He was awarded the Bronze Medal of the American Association for Textile Technology and was vice-president of American Association of Textile Chemists and Colorists. His hobby is golf. He is a member of AATCC, AATT, and The Fiber Society. . . . **Howard Marshak** and his wife Miriam live in Sarasota, Fla. He retired from Grumman Aerospace, Bethpage, N.Y., in 1977. . . . **John "Jack" C. Robbins, Jr.** of Irvington, Va., was production superintendent for American Cyanamid Co., Bound Brook, N.J. He has been married to Betsy since 1942. His hobbies are golf, fishing, and boating.

David N. Summerfield lives in New Berlin, Wis., with his wife, Harriet. His principal occupation was research, design, and manufacturing of universal and PM motors and portable electric tools. He worked for Skil Corp., Chicago, Ill., as chief engineer, director of research, and general manager in the electric motor division, and for the Milwaukee Electric Tool Corp. as manager of electric motor design research. He holds three patents and is author of several papers on universal motors. He was alternate U.S. delegate to the International Electrotechnical Commission—Power Tool Group, and chairman of the technical committee of the Power Tool Institute. He volunteers time providing income-tax assistance to the elderly and conducting hearing tests at a local hospital. He is a member of the Milwaukee Zoological Society and still does some consulting.—**Lester M. Klashman,** Secretary, 289 Elm St., Apt. 71, Medford, MA 02155

38 50th Reunion

While it is too early to tell how many of you will attend "1938" in 1988, at least two of you wrote me for information about our reunion—**Larry Hofstein** and **Harold Butler.** I can tell you that the committee has arranged for five clear and sunny days and an excellent program.

Larry added that he is keeping occupied as an art student and sculptor while continuing on the admissions committee of the ASME. His wife is executive director of the Mental Health Association of Nassau County.

Do you remember **Ed Hadley's** challenge regarding relatives attending M.I.T.? Well, **Dick Henderson** has picked up the gauntlet, with his uncle George Henderson, '06, his brothers Robert '30, and Donald, '32. Can you top this?

Russ Coile writes that he has changed jobs and is working for Evaluation Technology, Inc. in Monterey, Calif. He's still in "operations research," but in a company with six employees instead of 30,000!

Tice Boissevain retired from Electric Boat after 30 years, then re-retired after one year with Stone and Webster. Never satisfied, Tice started Computer Country Corp., which he says is still growing. If you're around Noank, Conn., this summer, you'll see him sailing his new 31-foot Bombay Clipper sloop.

Charlie King has found a very unusual way to avoid the chill of winter—he spends October to March in Cape Town, South Africa, where he has a duplex and where his wife, Carla, has family. He plays a lot of golf at the Royal Cape Golf Club. They spend the rest of the year in Oakland, N.J.

Last item: **Frank Kemp** finally deserted Connecticut and moved to Alexandria, Va.—**Armand L. Bruneau, Jr.,** Secretary, 663 Riverview Dr., Chatham, MA 02633

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On January 30 a new Boeing 747 jet set a new record by girdling Earth in less than 37 hours. Thirty-niners who were members of Boeing and so contributed to its achievements include **Holden Withington, Hans Bebie, Jim Barton, John Alexander, Dick Loesch, George Parker, Sid Silber, Ted Snow,** and **Ed Fish.**

Mel Falkof and Lucille write: "We travelled to the northwest autonomous region of China (recently opened to outsiders), Japan, India, and Southeast Asia. In Costa Rica I was a volunteer with the International Executive Service Corps, consulting with a local supermarket chain. And for two months each year we live and work in a kibbutz in the southern Arava Desert, where our son, Myles, '72, has been since his graduation."

Eli Dannenberg and Janice are enjoying residence these last three years at Longboat Key, Fla. In retirement, Eli travels to consult in the carbon black and rubber industries. In Florida, Eli serves both as a director of the M.I.T. Club of Southwestern Florida and on nearby tennis courts.

Bob Touzalin and Aletta plan seven months of travel during 1988 that will include skiing at Aspen, canal boating in Europe, and visiting friends and family in north central U.S.A. Bob and Aletta embrace the theory to travel while they can, which they say will be "until the suitcases get too heavy and the rest rooms too far apart."—**Hal Seykota,** Secretary, 1701 Weatherswood Dr., N.W., Gig Harbor, WA 98335

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Raymond Keyes of Richland, Wash., has had a problem. He writes, "1987 has been a year of frustration trying to master our IBM PC junior obtained through my youngest son, who works for IBM on their 3600 unit. The experience reminds me of a similar effort trying to master the first course in freshman physics."

Other news comes by way of **Alvin Guttag** of Bethesda, Md. Al, as Course V secretary, sends out an annual mailing to Course members. He received several replies, which he forwarded to me. **Samuel Omansky's** note from Sun City Center, Fla., states that he is doing well following heart bypass surgery a couple of years ago. He has moved to larger quarters in the same area. Occasionally he sees **Dan Dannenberg** at meetings of the M.I.T. Club of Southwest Florida.

Al's card from **Fred Magnusson** says, "Attended a 50th reunion at University of Michigan, and am looking forward to one at M.I.T." **Worden Waring** sent Al a long letter telling of his activities over the past year, such as entertaining "adopted" children and grandchildren from such exotic places as China and Mexico, and vacationing near the California coast. He ended on the sad note that his wife passed away in November. Our deepest sympathies to you, Worden.

Marion and **Garrett Wright** sent a family letter to Al, with pictures of the proud grandparents and individual snapshots of all nine grandchildren artistically arranged on the page. When Garry was feeling well in September, they had a great trip to Oregon. Now travel is difficult, but they would welcome visitors any time.

Please send along any news about yourself or other classmates.—**Richard E. Gladstone,** Secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

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Leona Norman Zarsky called from Brookline with the sad news that **Michael Driscoll** died January 18 at University Hospital, Boston, after a short illness. He was 68. After graduating from M.I.T., he received a law degree in 1954 from Northeastern University Law School. He was admitted to the Massachusetts Bar Association in 1955. Mike was in private law practice for the past 20 years in Nantucket. He was a member of the Nantucket Rotary and the Nantucket Sewer Advisory Commission, former chairman of the Nantucket Handicapped Access Committee, and past president of the New England Cemetery Association. Mike was also a former Brookline Town Meeting member, and a member of the Brookline Knights of Columbus. A famous skater, he was on the 1941 North American Skating team and was Eastern Pairs figure-skating champion in 1941. Mike was a lieutenant in the Army Corps of Engineers for 10 years until the early 1950s. He leaves his wife, Patricia A. (Moran), a son, five daughters, and four grandchildren.

Laurence C. Turnock, a cross-country runner while at M.I.T., has retired as president of the American Iron Ore Association. Since then, he writes, "I have been almost too busy with civic duties (in Chagrin Falls, Ohio), and with golf. I was recently appointed foreman of the grand jury of the Cuyahoga County Common Pleas Court for its January-April 1988 term.

Milton R. McGuire tells us that he is still in retirement in Los Altos, Calif., with a family that is proud of 14 grandchildren. He enjoys traveling, golf, and antique automobiles.—**Joseph E. Dietzgen,** Secretary, Box 790, Cotuit, MA 02635

42

Well here we are in **Ken Rosett** Associates' winter quarters in Clearwater, Fla. Moved here just before Christmas, just in time to miss the January deadline for the April Class Notes. Work in the morning and play golf every afternoon. Our condo overlooks the 13th green at the Top of the World Golf Course. A first-class arrangement for sure.

Very pleasant visit from Joan and **Dick Knight,**

who live on Bellaire Beach, not far from here.Dick came to Tech with our class, flew in the navy during World War II, and graduated in '47. You'll remember him as the most efficient secretary of the Alumni Association during the '60s and early 70s.

Jean and I have been at two fine meetings of the active Greater Tampa Bay M.I.T. Club. One was a dinner at the St. Petersburg Yacht Club, and the other a luncheon at the Sarasota Country Club. **Ben Skinner,** who lives in Dunedin (about 10 minutes from here), is on the board of directors of the yacht club. Ben keeps busy with his boat and with running Allied Precision Products, his machine-tool company in Dunedin. . . . At the Sarasota meeting lunched with Anne and **Bill Rote,** who winter at Sarasota and summer on Cape Cod. They have been down here for some years, since Bill's retirement from Polaroid.

Catching up on correspondence . . . **Will Yocum** is retired and currently tutoring high school students in math—algebra through calculus. . . . **Charlie Ruckstuhl** is still our #1 (or at least earliest) computer mavin. Remember, he was the statistician for the 25th reunion. We ought to get him started on the 50th. He has information from over 3,500 78-rpm records from 1900 to 1955—all stored on his IBM PC with Lotus 1-2-3 software. Free info for you other hackers.

Was pleased to have been invited to make the presentation of the Annual American Ideals award in New Rochelle, N.Y., to **Jim Stern.** M.I.T. was represented by **Alan Katzenstein** and **Tom Stern,** Jim's youngest brother, who got his S.B., S.M., and Sc.D. in Course VI and since has been professor of electrical engineering at Columbia.

Charlie Stempf volunteered himself and his Subaru as support for an entrant in the Solar Machine race from Darwin to Adelaide. It could only happen to Charlie: his Subaru broke down, it took six days to get parts, and by the time the car was repaired the race was half over! . . . **Bob "Hawk" Shaw** writes that **Mort Goulder** is on the board of the M.I.T. Club of New Hampshire and is also a trustee of Bob Rines' Law School at the University of New Hampshire. . . . **Don Stein** retired from the Military Sealift Command and is dividing his time among two grandsons, his wife, gardening, making furniture, traveling, and doctors. . . . **Morrie Steinberg,** retired from Lockheed, is a member of the National Research Council Committee. Its recent report on space technology presents recommendations to NASA for development of advanced propulsion technologies, space science, space transportation, and humans-in-space programs. . . . Copy of a letter to Bill Hecht, '61, executive vice-president of the Alumni Association, describes a collection of books at the Moberly Junior College library dedicated to the memory of **David Stamper,** killed in action during World War II.

Two obits: **Paul Gomez** of Course II died in Inglewood, Calif. A note from **Eric Wormser** and a long article from the *Stamford (Conn.) Advocate* report that Eric's wife, Margot died last October. She had cancer for several years but did attend our 45th reunion last June. Margot was executive director of the Stamford Housing Authority and was always active in class affairs.

That's it for now. Must go downstairs and play golf!—**Ken Rosett,** Secretary, 2460 Franciscan Dr., Apt. #96, Clearwater, FL 33575 (winter address till May)

43 45th Reunion

The first news item this month is, regrettably, an obituary. **Sidney L. Hall, Sr.,** of Brookline, Mass., died November 17, 1987. Sid was a track star in high school and college, and an Air Force veteran of World War II. He founded the Hall Manufacturing Co. in Brookline, and was active in civic and church organizations. He is survived by his widow, Betty, five children and 11 grandchildren. We extend our condolences to the family.

AMACON, the publishing arm of the American Management Assoc., will soon publish a book authored by **George Freeman,** *The Pursuit of Innovation*. George has spent 40 years organizing and managing innovation, which has resulted in more than 50 products and ventures, as well as some 20 technologies incorporated into production processes. His corporate positions include founder and president of Tyco Semiconductor Corp., and director of Raytheon's New Products Center. His name is on 20 patents, 30 technical articles, two technical-writing handbooks, and several awards from technical journals. He is chairman and fellow of the International Microwave Power Institute and a technical editor for *Solid State Technology* magazine. He is on the faculty of the Harvard School of Dental Medicine and does research on prosthetic materials.

After many years as president and CEO of GenRad, **Bill Thurston** is relinquishing this position to become the company's first chairman. He will be succeeded by another M.I.T. alumnus, Robert E. Anderson, '60.

This is the last edition of the Class Notes you will see before the 45th reunion in Newport. I hope you're all ready, and I'm looking forward to seeing you there.—**Bob Rorschach,** Secretary, 2544 S. Norfolk, Tulsa, OK 74114

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Frank Chin writes to tell us that both of his sons, Roger at Syracuse and Gary at Lehigh, expect to graduate this year. Frank is still working at Chiquita Brands and has no retirement plans at present. . . . **Edward Sanders** has been retired for five years. He is doing volunteer work, traveling occasionally, and flying his own plane—a Cessna 182. He would like to hear from classmates in the Washington, D.C., area. He is at 2788 Fort Scott Dr., Arlington, Va. . . . **John Chamberlain** retired from United Technologies Corp. last September.

Ray Frodey is retired, and he and Arlene are enjoying the energetic pursuit of nature photography. They are now getting published—both pictures and articles on nature—and their slide programs are in some demand by various groups around their home state of Michigan. Our congratulations to both of them. Further kudos go to **Jim Weaver,** who has been elected a fellow of the American Association of Cost Engineers. This designation is given to those "who are recognized by their peers as having made significant contributions to the cost engineering profession." Jim is a retired vice-president of ICI Americas, where his specialty was economic analysis of corporate ventures—from expansions to acquisitions to divestitures. He is also a fellow of the American Institute of Chemical Engineers. He is now living in Florida and manages to find time to play tennis, swim, and play his clarinet with the Sarasota Jazz Club.

Stay on the alert for news of the 45th reunion.—Co-Secretaries: **Andy Corry,** Box 310, West Hyannisport, MA 02672; **Lou Demarkles,** 53 Maugis Hill Rd., Wellesley, MA 02181

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Congratulations to **Emily Vanderbilt Wade** on her election as president of the Alumni Association for the 1988-89 year. Paddy, your classmates wish you well as you take on this vital activity, just one of your and Jeptha's countless philanthropic interests.

John H. Helve, a 1986 retiree, moved to Etowah, N.C., last November; he would like to hear from his V-12 classmates. . . . **Emmett E. Day, Sr.,** retired from the University of Washington in 1985 after 38 years as professor of mechanical engineering and 15 years as associate chairman of the department. He is now traveling internationally, skiing the Northwest and boating in the nearby San Juan Islands, and continues to be active in both ASME and S.E.M. . . . **Max Ruehrmund** retired from General Foods Corp. on September 1, 1985, after 39 years, 5 months, and 21 days. Max and Trudie divide their time between Dover, Del., and a waterfront farm in Rock Hall, Md.

Our January comments provoked a most amusing February 4 letter from **Charlie Patterson** of Attleboro, Mass.: "While my input has been most sporadic over the years, your retirement/adolescence comments leaped out and only my usual reserve prevented a collect call to identify my category. Although I did retire from Texas Instruments after 37 years, I somehow consider myself between jobs as it's only been since September, 1983! As to adolescence, I consider myself quite mature; and being so I shall refrain from asking Jan how she would cast the other 50% of the family vote." Charlie's letter included enlightening comments on October 19, "Black Monday", such as think cost, don't think of new price levels, and harrowing golf stories, a planned spring visit to daughter Sue and family in Wayzata, Minn., etc. Charles, your letter made my day! I only wish that others would follow your lead.

Prexy **Chris Boland** along with Jean were with us here in New Castle last evening following their usual February cross-country ski visit to Jackson, Wyo. As you might expect, Chris had many interesting comments to make about his beloved Wall Street.—**Clinton H. Springer,** Secretary, P.O. Box 288, New Castle, NH 03854

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Here in Colorado it's still wintery as I etch out this alleged ode to spring, but never mind; good news is where one finds it. By the time this reaches you, I will have become, barring some exigency, a member of the "gray panthers," retiring with minor regrets. Small matter—more like a release from bondage. Anyhow, the show goes on, starting with a pipeline message dated December 4 from Jan and **John Maynard** telling of their 12 wonderful days in West Germany—golfing (of course) and sightseeing—and extending welcome to visit them in Palm Beach Gardens, Fla., any time. We'll get there eventually, John.

Aside from that, all we have is another set of interesting stories from the bio book: I don't think I've mentioned **Ed Belcher** before—don't ask why—maybe because he was in the June class. At any rate, Ed, originally from Plymouth, Mass., got his Course II letters (along with a bunch of extracurricular activities) before his professional years in assorted companies, ending with his presidency of Caldwell Manufacturing, Rochester, N.Y., in 1975. Ed's into liberal courses—integration, arts, committees, task forces—and, along with wife Gayl of 12 years, "lives a mighty good life," with a weekend house on Canandaigua Lake. He looks forward to post-retirement volunteer work. . . . Likewise I might have overlooked **Bob Connor,** an "Ahlington" High preppy and Course XVI confrere, showing up in San Pedro, Calif., after tours with NASA (Langley), Douglas, and Northrop, and finally with TRW in systems engineering and orbital operations. Married Joan (at TRW), who runs her own small restaurant and produced two (nontechnical) daughters. Bob has maintained his thespian interests, working in local community theater and so on. Sounds like fun.

Here's an update on **Jack Fleming,** a V-12 Company 7 hallmate out of Franklin, Pa., and yes, another XVI aeronaut, who picked up an S.M. and wife at "Pitt" in '49. After some promotive years with Joy Co., the Flemings went west, settling in Apple Valley, Calif., with Jack joining Pfizer, Inc., to work in their lime-talc plants, and (in 1981) to Southwest Portland Cement to modernize a 100-megabuck plant with lots of international spice/travel. He seems happy enough to hang in there while wife Cleo works her artistry and Jack works on old cars and everything. Finally, an interesting resume of **Jerome Fischler** from our September IX subset, but not in the

Technique, has him up in classy Palos Verdes, Calif., following a 1945 marriage to Florence, stints with Republic, Martin, Northrop, and finally MacDougle (nee Douglas Aircraft). Along the way he sired three children (ages 32-40) and has three grandkids. He's still looking at another MacDougle project, traveling, tennis, and "investing."

Let's run it up the flagpole and see if anybody salutes it.—**Jim Ray,** Secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

48 40th Reunion

Plans for our 40th reunion on October 7-9 include an opening talk by Lester Thurow, dean of the Sloan School of Management. Dean Thurow, speaking on CBS's *60 Minutes,* pointed out how economic forces already in existence will dictate future events. He projects a reduction in the standard of living in the U.S. and problems in productivity due to insufficient training of workers. He says America is an under-engineered society, which leads to lags in implementing new process technologies. Our second speaker, Ed Roberts, professor of management at M.I.T., recently wrote a book, *Generating Technological Innovation.* He has researched how entrepreneurial and venture enterprises are changing our society. We have asked for a presentation during lunch by students working on *Daedalus,* the project to pedal a human-powered plane 74 miles from Iraklion, Crete, to the island of Santorini. Dinner will be at the Museum of Fine Arts in Boston.

On Saturday morning, Woodie Flowers, associate professor of mechanical engineering, will talk about design and teaching design. Students in his course are provided with a kit of materials that might include a motor, rubber bands, wire, plastic strips, wheels, and gears. The students design and construct something to compete on a track or path with the products that the other students have designed. On the day of the competition, Room 10-250 is packed with an audience cheering the competitors. Our second speaker, Alex Slocum, assistant professor of civil engineering, has been appointed to an endowed chair funded by our classmate **George Macomber.** Alex and his students have designed and built machines that range in size from robots to automate tasks in building construction to machines that measure the surface of large bacteria and viruses such as gonorrhea and AIDS. At lunch we will relax with Jay Keyser, who teaches poetry, among his numerous responsibilities as professor of Linguistics and associate provost. Speaking with humor but very much to the point, he shows how subtle messages in our communications reinforce the primary message.

Our dinner/dance is scheduled for Saturday night at Walker Memorial. Eleanor and **Harold Ottobrini** will create an atmosphere suited to our 40th reunion. Those of us who danced at Walker on Saturday nights in the forties will have the opportunity to reminisce about the good times. Sunday plans are not finalized. Read next month's column for the next chapter of our story. I have attended all our class reunions. Judging from pictures that I took at the Mayflower Hotel in Plymouth at our 5th reunion, there were at least 17 classmates attending. Using attendance lists for the other reunions, I prepared a summary *(see box).*

At our 25th reunion, 42 classmates came to their first reunion. If 48 classmates come to their first reunion next October and if 122 classmates come again, I project an attendance of 170 classmates, with an anticipated total of 300 including guests.

I am excited about such a big reunion and the opportunity to renew friendships. **Bob Sandman,** chairman of the 40th reunion committee, and his wife Tel invited Boston area classmates to their home to begin a series of warmup parties prior to the reunion. The first, on Superbowl Sunday, was attended by Ginny and **George Clifford,** Gloria and **Sonny Monosson,** Martha and **Bill Katz,** Judy and **Graham Sterling,** Ann and **Ken Brock,** Gloria and **Herb Lipson,** Ann Marie and **Paul Anderson,** Jean and **Jack Juechter,** and Jean and **Milt Slade.**

Class of 1948 Reunion	Number of classmates attending	Total number of classmates attending at least one reunion
5th	17	17
10th	81	87
15th	63	117
20th	104	166
25th	124	208
30th	79	227
35th	76	241
37th	36	244

Sam Hanna, professor of mathematics in the School of Management at Boston University, has been going to Monte Carlo for several years to compete in the world championship for backgammon players. In 1987 he finished third. He and his wife Joan have three sons. . . . **Cliff Sell** is three-quarters retired from his position as a manufacturer's representative. He has been in sales all of his business career and has handled some major lines, such as Sutorbilt. His oldest son was killed on military duty in Vietnam during the war, and he has three other children.

Stan Shein operates a firm to implement computer-based solutions for other businesses. His monthly newsletter is in its 17th year and provides provocative thoughts for Stan's clients. A recent column stated that you cannot manage what you cannot measure. He offered several guidelines to help determine what has to be measured and can assist a company in establishing a broad-based strategic information management system to fulfill the objectives.

Bill Maley and a partner have a business in Milford, Conn., formed in 1959, to design and manufacture lighting for the transportation industry. Bill's son has joined the business. Another son lives in New Hampshire, and his teenage daughter is a sophomore in high school and lives at home with Bill and his wife Betsy. They have one grandson. Bill is on the board of directors of the Milford Hospital and the YMCA. He has also helped the local M.I.T. club and has worked on several alumni campaigns soliciting funds for M.I.T.

Milton Widelitz continues to do one real estate development project each year. During the past eight years, most of the development work has been at airports. Milton and his wife Misty have one grandson, who Milton says may set some records with his wailing. Milton and Misty travel in their airplane and also have a helicopter for camping and exploration.

Bill Kushner died two years ago. He had been living in New York City. . . . **Holmes Taylor** died last June. He and his wife had been living in San Diego. On behalf of our classmates, I extend sympathy to their families and friends.—**Marty Billett,** Secretary, 16 Greenwood Ave., Barrington, RI 02806

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Credit where credit is due department: last January, when I reported on the October 1987 installation of **Richard K. Pitler** as vice-president and trustee of the American Society for Materials, I should have mentioned that he recently retired as senior vice-president and technical director of Allegheny Ludlum Steel at Watervliet, N.Y. He had been with the company for 36 years. My excuse: they didn't tell me until now.

A $500,000 commitment by Thermo Electron Corp. of Waltham, Mass., has established the **George N. Hatsopoulos** Junior Professorship in Thermodynamics in the Department of Mechanical Engineering. The chair honors Hatsopoulos, who founded Thermo Electron in 1956 and is currently chairman of the board and president of the corporation. In addition, he is chairman of the board of the Federal Reserve Bank of Boston. Thermo Electron, with 4,000 employees worldwide, develops, manufactures, and markets environmental and analytical instruments, custom-engineered and prepackaged cogeneration systems, equipment for industrial processes, biomedical materials and products, and fabricated biomedical and aerospace components. Hatsopoulos and his wife Daphne live in Lincoln, Mass. They have two children, Nicholas and Marina.

An obituary in the December 3, 1987, issue of the Quincy, Mass., *Patriot Ledger* tells of the death of **Fred O. Wissenbach** at age 76. For 34 years, Fred was a resident of Canton, Mass., and had retired as a vice-president of Felton & Sons, Inc. of South Boston. At the time of his death, he was living in Gulfport, Fla. Fred was born in Germany but moved to the U.S. at an early age. He was an army veteran of World War II. During his years in Canton, Fred was a member and staunch supporter of the Society for the Preservation and Encouragement of Barbershop Singing in America, a member of the Citizens Band Club, and an avid chess player. Fred is survived by two daughters, a sister, seven grandchildren, and one great-grandchild.—**Fletcher Eaton,** Secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

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On October 24, 1987, at the M.I.T. chapel, **Robert G. Norton** was married to Carol Nancy Burnham. Accompanying this announcement was word that Robert is retiring and starting a consulting business. We all wish you much happiness from the first event and much success from the second. . . . Following his retirement from Exxon, in 1984, **David R. Esty** is devoting his time to golfing and fishing in Florida. . . . Last October, **Anthony E. Mirti** left his position as president and chief operating officer of Hi-Shear Industries, Inc. of North Hills, N.Y.—**Martin N. Greenfield,** Secretary, 25 Darrell Dr., Randolph, MA 02368

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This issue's news deals mostly with careers. **Anthony Jamroz** is now a senior vice-president for marketing, sales, and service for Telco Systems of Norwood. He was formerly president of a Telco subsidiary in Fremont, Calif. . . . **Jack Larks** says he is now established as a forensic safety engineer. Working out of Houston, his practice extends from Atlanta to Honolulu. He claims to need everything he learned at M.I.T. That has been my experience, too. The trouble comes from the things not learned. . . . **Michael Cambon** laconically writes that he retired last year, and now consults. . . . **Collin Scarborough** also consults, with an independent practice, through Madison Rye, Inc., of Rye, N.H. Neither says what field he offers advice in.

Nicholas Haritatos continues to work on petrochemical projects for Chevron, including fer-

The Gordon Institute: Bernie Gordon's Contribution to U.S. Productivity

"To develop and train experienced engineers to become exceptional engineering leaders . . . engineers who can conceive, design, and produce new competitive equipment that redefines the state of the art." This is the mission of The Gordon Institute, says Bernard M. Gordon, '48, president of the institute and chairman and president of Analogic Corp., Peabody, Mass.

Because of his concern over low productivity in the U.S., undereducated engineers in this country, and markets currently being lost to foreign competition, Gordon founded this graduate school for engineers in Wakefield, Mass., which offers a one-year curriculum leading to a master of science in engineering management.

The program is intended for engineers with at least three years' experience in industry, and students are sponsored by their companies. Students are expected to develop a commercially viable product for the sponsoring firm during their year at the institute, an undertaking that accounts for about 45 percent of the course load. "A marketable product would be sufficient justification to finance a student," observes Martin S. Gordon (no relation), president of Medical Electronics Laboratories, Inc., Danvers, Mass., and a satisfied sponsor. "But, if after a year we get a motivated leader, that is even better. If we can capitalize for several years to come, it's clearly worth the investment."

"I wanted to get some formal training in management, but I didn't want to sacrifice my 'technical edge' to attain it," said Michael Greim of PictureTel Corp., Peabody, Mass., during The Gordon Institute's mid-year report last December. Although he was at first hesitant to attend a graduate school in its first year of operation, he emphasized that he is pleased with the education he is receiving.

Besides the time devoted to their projects, students spend 15 percent of their time with mathematics and science, 15 percent in advanced technology, 15 percent in project engineering, and 10 percent with humanities. Some of the first-year projects include a graphics subsystem for teleconferencing, patient monitoring telemetry, an analog-to-digital converter, and data acquisition for a CAT scanner. The faculty currently includes 6 full-time and 13 part-time members, as well as nine consultants.

The institute has an academic budget of over $100,000 for each student during the school year—about six times the tuition fee—and the difference is borne by the institute.

Why does the Gordon Foundation underwrite this cost? Gordon is confident that sponsors will receive high value from their participation in the program and that they will choose to provide additional funding to the institute commensurate with the value they receive.—*Sandra Knight* □

tilizers, alpha olefins, and polyethylene. Perks of the job have included a trip to a Wyoming fertilizer plant in January and two trips to a polyethylene plant in southern France. Both of Nick's children are now in college. Son Christofer is a music major at University of Chicago, and daughter Edith passed up M.I.T. to go to Johns Hopkins, looking toward a career in medical research.—**Richard F. Lacey,** Secretary, 2340 Cowper St., Palo Alto, CA 94301

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It's not too early to start planning—our 35th reunion is just about a year away. We will keep you posted as details emerge. In the meantime, why not drop us a line about how you have been using those 35 years?

Our annual reminder has come from **Don McGrath** that he is proprietor and winemaker of Villa Helena Winery in the Napa Valley and invites all of us for a tour and barrel tasting whenever we are in the vicinity. In his spare time, Don is chief scientist at Garrett Air Research in Torrance, Calif.

Klaus Zwilsky is executive director of the National Materials Advisory Board. He has just completed his term as a member of the board of trustees of ASM International, the society for materials.—**Edwin G. Eigel, Jr.,** Secretary, 33 Pepperbush Lane, Fairfield, CT 06430; **Joseph P. Blake, Jr.,** Assistant Secretary, 74 Lawrence Rd., Medford, MA 02155

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Sandy Goldman informed us that he has recently expanded his seminar and technical publishing firm, T-MAC, to new offices in Norwood, Mass. He greatly enjoys presenting seminars on time effective engineering and management seminars for CEOs and their staff on fostering creativity and quick response engineering. Sandy also says that technical publishing is very complex and that, for the moment, McGraw-Hill's position is safe.

Karl Reuther tells us that he has just established an ESOP at Reuther Mold Making for the employees. He states it's a big change from being a solely family-owned business. Karl is still president and has no plans to retire. He has a new grandchild, Katelyn, his third and is looking ahead to our 35th reunion.

David Kramer let us know that he is still with the Rocketdyne Division of Rockwell International (it has been 30 years), and is now working on ultra-high temperature materials for the national aerospace plane program. He also has begun drawing abstract pictures in colored pencil and pastel. Just to rub it in, he tells us that his balcony overlooks the ocean at Port Hueneme, Calif.—tough life.

Just to show you we are on the job, two of our classmates appeared in magazine articles. **Ralph Wanger,** president of Acorn Fund, Inc., a mutual fund in Chicago, was quoted in the *Christian Science Monitor* last December concerning the impact of the October stock market plunge on his advertising. He stated that he didn't have to change his advertising budget because his entire advertising for the year consisted of a $320 advertisment in the program for his daughter's high school drama production. On a more serious note, he did state that his investors were quite supportive after October 19, which speaks well for his fund.

Science News reported that **Donald Eckhardt** led a group at the Air Force Geophysical Lab in Hanscom, Mass. that detected minute additions to gravity which may be the manifestations of a sixth force.

Thanks to everyone who contributed this month. Keep the information flowing, and we'll keep our eyes open for news in magazines and the newspaper.—Co-secretaries: **Robert P. Greene,** 37 Great Rock Rd., Sherborn, MA 01770; **DuWayne J. Peterson, Jr.,** 201 E. 79th St., New York, NY 10021

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Robert S. Carlson teaches one semester a year as professor of finance at the University of Hawaii, and manages his Waikiki Real Estate and travels the Pacific Rim the rest of the year.

Irwin Dorros has been appointed to the FCC Advisory Committee to develop recommended standards for a new high-definition television system. Irwin obtained his master's degree as well as bachelor's degree in 1956; he resides in Morristown, N.J.

We had a snafu in our November/December column on information reportedly from a March 31, 1987, *Wall Street Journal* article; we reported that **Samuel S. Friedman** held a new position. He was sure suprised to find out he had changed jobs via the class notes. He wrote **Irwin C. Gross** to inform us that he remains a partner in the law firm of Lord, Day, and Lord. (Irwin informed Sam of the lengths that class secretaries were willing to go to get a letter from a classmate.) Sam remains appreciative of the time and effort to gather class notes with congratulations, but hopes we will be more accurate and careful in the future; we will do our best.

Thelma K. Pollard of Hollis, N.H., writes that after her husband, Bob (chemical engineering), died in January 1985, she wanted to do something that would honor his life and perpetuate his memory. She decided on a scholarship fund

at M.I.T. with particular consideration to be given to chemical engineering students. This seemed appropriate since Bob loved his years at M.I.T. and because he was a student all his life, constantly seeking new knowledge and being interested in education. She writes because she thinks some of Bob's classmates will be interested in knowing this, perhaps for their own children. The scholarship should be fully funded by mid-1988. Many thanks to Thelma for her thoughts and action.

Our best to all and let us hear from you.—Co-secretaries: **George H. Brattin,** 39 Bartlet St., Andover, MA 01810, (617) 470-2730; **Irwin C. Gross,** Sweet's McGraw-Hill, 1221 Ave. of the Americas, New York, NY 10020, (212) 512-3181

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James J. Coles, who received an S.B. and an S.M. in Course VI and lived in Bridgeport, Conn., died recently in Boston.

Boyd Givan has been appointed vice-president, financial operations, of the Boeing Co., Seattle, Wash. . . . **Bill Alcorn** joined Camet Co., Hiram, Ohio, as manager of R&D. Camet manufactures catalytic converters for vehicles and stationary sources. . . . **Henri Slezynger** is the managing partner of Proquigel Quimica Ltda., Sao Paulo, Brazil. He is also a director of the Brazilian Chemical Society. . . . **Larry Young,** professor of aeronautics and astronautics at M.I.T., served on a 16-person committee of the National Research Council that recently made recommendations to NASA on future directions for the space program.

Charles Murray writes that he is board certified and practices medical oncology at the Park Nicolet Medical Center in Minneapolis. He has been elected to the board of trustees and now serves as treasurer of the center.—**John Christian,** 23 Fredana Rd., Waban, MA 02168

58 30th Reunion

Reunion time! It's never too late to make reservations for the 30th reunion at the Harbor View on Martha's Vineyard on June 3-5. **Roy Scarpato** and the reunion committee have planned a great weekend. Enjoy the ferryboat ride to the Vineyard Friday evening for the cocktail party and clambake dinner. On Saturday, there'll be sports events, beachcombing, and visiting historic Edgartown and Chappaquiddick Island.

Following the Saturday evening reception and dinner-dance, we'll have the hilarious reading of the class profile. Relax over brunch on Sunday morning, and then catch the ferryboat back to the mainland. If you haven't filled out the class profile questionnaire yet, rush it now to **Dick Rosenthal** so that your info can be included. Also, please send your class dues of $20, which helps defray the cost of mailings to all class members as well as various operating items during the years between reunions. Send class dues to **Steve Hadjiyannis** at 21 Indian King Dr., Cherry Hill, NJ 08003.

Received a brief memo from **Bob Rose** noting, "This year it will be 26 years on the M.I.T. faculty! Where is *Voo Doo* now that I need it?" . . . **Harold Samuels** is now president and chief consultant for Samtech, Inc., based in Scarsdale, N.Y. His company specializes in telecommunications, office automation, and micro-computer systems. . . . Recently, **Robert Kolk** left Wang Labs to accept a new position as vice-president of NEC Information Systems, Inc., in Boxborough, Mass. In this position he will direct the company's product planning and management group and will be responsible for all development of NECIS systems hardware and software products. . . . Out in Gilroy, Calif., **Tom Wolony** continues to expand his company, Quick Reaction Corp. Tom says that QRC always has room for more RF engineers.

Fred Nadel writes to say, "I'm looking forward to our class reunion! Just celebrated the 11th anniversary of my business management consulting practice for small businesses." . . . The Instrument Society of America presented **Edgar Bristol** with its Annin Award for contributions to the application of artificial intelligence to process control. His activities at the Foxboro Co. focus on computer science and control systems research. Edgar has published more than 50 papers related to process control and holds several patents in the field of adaptive and compensatory control.

We hadn't thought of the TV ad "where's the beef?" for some time, at least not until a letter arrived from **Dan Brand.** In it, Dan notes, "I'm now vice-president in charge of transportation consulting. We are starting to have private clients interested in building public transportation systems, mostly magnetically levitated urban and intercity high-speed and super-speed rail systems of German and Japanese design and backing. Where's the American technology??" . . . Another nice note in the mailbag comes from **Ed Bell:** "My oldest son Walt was married in August, and he and his wife are living in Long Beach where Walt is an independent consultant in systems design and programming of personal computers. My daughter Leann is leaving Norway for a year of study at Monash University in Melbourne, Australia, on a scholarship from Rotary International. My youngest son Mark is studying economics at Hull University in England during his junior year under the University of California (Berkeley) education abroad program."

Both Nancy and I look forward to seeing you all at the reunion. I managed to miss last month's column due to a severe bout with the flu, but this lengthy missive is intended to compensate.—**Michael E. Brose,** Secretary, 841 Magdeline Dr., Madison, WI 53704

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Shel Epstein writes from Deerfield, Ill., that he and wife Suzy are now empty-nesters, and "it's like being on a honeymoon again." Shel's business, Epstein Associates ("every little bit counts") specializes in engineering and servicing computers for industrial and research applications. He invites classmates visiting Chicago to give him a call—he's only "20 minutes from O'Hare."

Recently I spent a pleasant evening with **Bob Gurnitz,** a fellow Course Xer who is president of Bethlehem Steel's Shape and Rail Products Division. Bob, Ellen, and their two daughters live in Allentown, Pa.

Since you didn't send me much news this month, I will put on my class agent's hat (the hat is a Washington Redskins helmet 'cause I'm celebrating yesterday's—January 31—Superbowl win) and thank you for your generosity to the Alumni Fund. Many of you opened your checkbooks at year's end, as yesterday I wrote notes on and mailed 50 reply cards; today's mail brought 40 more cards from the Alumni Fund office. Remember that contributions received by June 30 will be counted in the current fund year.—**Frank A. Tapparo,** Secretary, 15 South Montague St., Arlington, MA 22204

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Have you missed me? Well, I have an excuse, sort of. I'm job hunting. Just after the new year began, the Institute announced that my department, Applied Biological Sciences, would be abolished. That meant everyone, staff and faculty, would be out of a job. The word processors and Xerox machines have been busy grinding out resumes and applications. So far no luck, but I have really enjoyed networking with old friends.

I am terribly sorry to have to report that **Stan Kulpa** died of surgical complications last November 15 at Walter Reed Hospital in Bethesda, Md. Stan had been coordinator of research at the army's Harry Diamond Labs. The entire class sends its regrets and condolences to his wife Linda.

It's hard to believe, but there are still some of us giving rise to children. On a letterhead from "the M.I.T.C.U. Corp." of Oceanside, N.Y., **Bert Pariser** sent notification that on July 6, 1987, his wife, Lora, gave birth to their fifth child, Amanda Joy. There is life in the old class yet! . . . Further proof comes from **Richard Stiffler,** who is engaged to be married (remarried, that is). He practices psychiatry in Framingham, Mass., lives in Wellesley, and is deep into writing a novel.

Paul Schweitzer writes that he coordinates operations research at the Simon School of Business Administration in Rochester, N.Y. . . . An article from the Greenfield, Mass., *Recorder* relates that **Richard Berendzen,** president of American University in Washington, D.C., has written his fourth book, *Is My Armor Straight? A Year in the Life of a University President.* . . . **John Benjamin** moved from South Bend to Wayne, N.J., where he is running GAF's Carbonyl Iron Powder unit.

Gus Solomons' Dance Co. is going strong in New York City. I got an announcement of a performance at St. Mark's Church last January and kept kicking myself for not getting up and going to see it. . . . **Ben Zarren** (remember him) was awarded a Lobdell Award by the Institute last year because of all the wonders he wrought at our reunion.—**Andrew Braun,** Secretary, 464 Heath St., Chestnut Hill, MA 02167

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Steve Brams is acting chairperson of the Politics Department at New York University for 1987-88. His book, *Game Theory and National Security,* coauthored with D. Marc Kilgour, will be published in both paperback and hardcover by Basil Blackwell in the spring of 1988. We always thought Steve was a talented political scientist, but if it's a "politics" department perhaps we should consider him a talented "politician?"

Yours truly, **Hank McCarl,** has been recently appointed director of the UAB Center for Economic Education here in Birmingham. The center is an outreach program to bring economic education to the public school classrooms in grades K-12. The UAB Center is one of six centers in Alabama working under the umbrella of the Alabama and National Councils for Economic Education, sponsored by donations from business and industry throughout the U.S. Recent programs sponsored by the UAB Center have included workshops on energy economics, economic geography (with assistance from the National Geographic Society), and "Understanding Taxes," that ever-popular spring pastime.

Dave Nickles writes that he has traveled many times to Japan over the last two years heading up a Du Pont team in joint venture with Mitsubishi Rayon concerning plant design and start-up. The Mitsubishi Rayon-Du Pont plant produces *Corian*[reg] in the city of Toyama. We must assume that Dave is enjoying traditional Japanese hospitality and eating lots of tasty sushi.

Ed Feustel writes that he is enjoying his new Commodore Amiga 2000 computer. While we don't know just what he's doing with it—playing the ponies or doing advanced graphics or perhaps playing sophisticated adventure games in 3D—he would like to hear more about others in our class that may have found new things to do with the Amiga. I can't help much since this column is composed on a Commodore 128 with a NEC Pinwriter P2200 printer. Perhaps Ed's inquiry will lead to more discussion among our classmates about adventures with their own computers. Remember when the IBM 709 and 7090 had about the same capabilities that we now have in our own desktop PCs? Do any of you have particularly interesting things to contribute about your favorite computer capabilities? Both Ed and I would like to hear from you. Drop a note to: **Hank McCarl,** Secretary, P.O. Box 352, Birmingham, AL 35201-0352

63 25th Reunion

A chilly morning in February makes it hard to remember you will be reading my timeless words in sunny May. But I shall press on undaunted.

I begin with excerpts from **Dave Johnson's** newsy Christmas 1987 letter. He tells us about the exploits of his first grandson, Lee, born in September, 1986, and goes on to comment on the continuing process of growing older. Dave, apparently you did not realize that a major cause of this business of getting older, which I for one intend to avoid, is the having of grandchildren. You have not set a good example by (I believe) having the first, at least the first reported, in our class. And I want all the rest of the class to work on the aging problem by vigorously undertaking not to have further grandchildren. Now, as I was saying, Dave's daughter Elizabeth (11) is seriously immersed in oboe lessons, dance (jazz and ballet), and her new cat. His wife Lyla is president of the local American Field Service chapter and a research assistant at Yale. Daughter Kitty (22) graduated magna cum laude and Phi Beta Kappa from Duke, majoring in French, and is now in France on a Fulbright. Son Bill (18) is in Indonesia as an AFS exchange student, one of few whites in Jakarta, a city of three million people, having been granted deferred admission to Emory. Dave himself has begun to tire of working hard and without recognition for a family-owned (someone else's family) business. He is earnestly job-hunting. Unfortunately he does not provide me, to pass on, what line of work he is seeking. An inveterate job-seeker myself, I wish Dave the best of luck. Dave and "core" family live at 635 Nut Plains Rd. in Guilford, Conn.

I received a rather touching article excerpted from the newsletter of C.S. Draper Lab about **Ray Carroll.** He, a staff engineer at Draper, and his wife Constance, associate director of the Visiting Nurse Association of Boston, have established an Alaskan Native Incentive Scholarship Fund with a gift to M.I.T. The financial objective is to raise a total of $50,000, interest from which would provide the scholarships. The uniqueness is Ray's reason: "As a young Alaskan native coming out of high school, I was so naive. I said, 'M.I.T. looks like the best school in the world so I'll apply to it.' I took all the tests and was really shocked when I received a letter of acceptance. I didn't have tuition money." An optometrist who cared voluntarily for Alaskan natives heard of the problem, paid for the first year and introduced Ray to Quincy Adams Shaw of Boston, who paid for the next three years. Ray says, "I only know of one other Alaskan native who has attended M.I.T. I'm gearing this scholarship fund toward grade school students so that when they get to high school they know that money will be available specifically for them." If you want to contribute, please contact Winifred McDonough, Treasurer's Office, 4-113, M.I.T., Cambridge, MA.

Finally, I have a little note culled from the November 28, 1987 *Wall Street Journal* that **Paul Richman** has been elected chairman and CEO of Standard Microsystems of Hauppauge, N.Y.

Linda and I are now established in our suburban town house, and this is my first column written from there. I am looking forward to gathering with as many of you as possible at our 25th reunion. If you can't make that, but plan to be in the D.C. area, please feel free to visit us.—**Phil Marcus,** Secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (301) 750-0184

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We are just one year away from our 25th reunion in Cambridge. According to **Bill O'Halloran,** our reunion chairman (reachable at 617-245-9090), we will be gathering June 8-11, 1989. More details to follow.

The column this month is devoted to the lightly-edited version of a letter sent by **Jim Lerner,** who took the time and trouble to reflect on the nearly 24 years of his life since graduation.

"I have wanted to write for ages, but never felt that I had anything 'newsworthy.' Most of the time I feel that the people I read about in your column are super achievers who have written this book, been promoted to that position of greater responsibility in the organization in which they work, or something similar. I am sure that more of us would write with news or thoughts if we somehow didn't have the nagging thought—I wonder if what I have done or have to say is significant. As for me, my course was set at M.I.T. and later at Stanford in aero and astro, though following a two-year 'sabbatical' in Europe during the energy crisis, I decided to enter the renewable energy field. I founded the California Wind Energy Program about 10 years ago, which resulted in the world's most successful wind energy project developments. Currently there are sited in California the equivalent of one nuclear power plant in wind turbines saving about 7,000 barrels of oil per day.

"After working in a government organization for a number of years I got the itch to be my own boss, and have consulted as a 'wind energy consultant,' founded a corporation to develop and operate wind energy projects, acquired a small oil and gas well management operation, and have done some management consulting for local start-ups seeking venture capital.

"Currently I am involved as a member of the QUEST Team (Quality Energy for Sacramento's Tomorrow) which is charged with providing an independent analysis of options for the Sacramento Municipal Utility District, which owns Ranco Seco, a 900-megawatt nuclear plant with a long history of unplanned outages. The district is faced with the decision to continue to operate the plant or shut it down. PG&E, the nation's largest utility, has offered to acquire the district's assets and debt, decommission the plant, and freeze rates for a few years. The voters will decide in June 1988 whether they want the plant to continue operating as a nuclear plant.

"There are so many challenges here in California with our growing population, dwindling support of education, and increased pressures on the environment (air pollution and toxics) that I will probably find some more challenging problems to occupy my time and energies in the coming few years. Yes, there are problems here in 'Paradise,' but for me, these problems are opportunities to do something interesting.

"With regard to my family, my older son, Zachary, is interested in flight, so I agreed to coach a team of 7- and 8-year-olds who will compete in the Odyssey of the Mind problem on the Gift of Flight. The problem is rather complex; they have to construct six different airplanes to fly on different courses or hit targets using less than $50 in materials and getting no ideas or direct assistance from their coach or parents. This should be a real challenge for me to offer encouragement without giving them any of my ideas as to how I would design it!

"My recollections of M.I.T. are somewhat vague at this time, though I do hold in the highest esteem the sound, quality education we all were given there. The way we were taught to think about solving problems is something that I carry with me always. I feel very privileged to have been in the company of so many bright, competitive people. I hope that the curriculum today offers more opportunity for the students to learn about how technology fits in with the rest of the world and what their responsibilities are as scientists or engineers and how these responsibilities go beyond simply solving interesting technical problems. My strongly-held opinion is that we really need to continue the human technology of building trust and making agreements to eliminate nuclear weapons rather than finding a technological solution that only increases the instability and expands the arms race." Thank you, Jim, for your letter. It sounds like you *are* accomplishing a lot. I hope that other classmates will follow your lead and send a letter.—**Joe Kasper,** Secretary, 3502 Idaho Ave., NW, Washington, DC 20016

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Joe Dyro has been promoted to research associate professor of anesthesiology at State University of New York at Stoney Brook Medical School. Music remains a favorite pastime of Joe's. He conducts the University Hospital Holiday Chorale and sings with the Long Island Symphonic Choral Association. The Choral Association performed Jacob Druckman's "Vox Humana" at Carnegie Hall last December, and the premiere got high marks from music critic (and Joe's fraternity brother) Gerry Lichtenberger, '66. . . . Civil engineer **Dave Moran** was appointed assistant technical director of the Navy's David Taylor Research Center last October. Dave's son, Scott, is a sophomore at M.I.T., and daughter, Lindsay, is a freshman at Wellesley. . . . **Scott Graham** has moved to Boston's Back Bay after 11 years in Silicon Valley and is now working for Digital Equipment Corp.

Sharon Ross writes that she is finally getting to see the U.S. with lots of professional travel. Sharon chairs the southeastern section of the Mathematics Society of America. Sharon still fences, but has been too busy to take part in many competitions. . . . **Chan Stowell** is vice-president of Claritas, a company involved in bringing geodemographic segmentation and other information technologies to consumer marketers. He describes the role as making the numbers part easy for the marketers so they can be creative ("God knows it's time!"). Chan got married on August 16, 1987 to Ronnie Sue Shadur. Chan and Ronnie live in Evanston, Ill., with Ronnie's daughter. . . . **John Holdren** is professor of energy and resources at Berkeley and is chairman of the American Academy of Arts and Sciences' U.S. Pugwash Committee, which sponsors international gatherings of scientists, scholars, and public figures.—**Steve Lipner,** Secretary, 6 Midland Rd., Wellesley, MA 02181

66

Tom McDonough's first novel, *The Architects of Hyperspace,* has been nominated for the Nebula Award by the Science Fiction Writers of America. . . . A news release from the Optical Society of America reports that **Alexander Sawchuk,** of the University of Southern California, has been elected to a position on their board. At U.S.C., he is professor of electrical engineering and director of the Signal and Image Processing Institute. . . . Alan Fener lives in Silver Spring, Md., with his wife, Judy, and a son and daughter. Alan is a labor law attorney, working as deputy assistant general counsel with the National Labor Relations Board in Washington, D.C.

Don Morrison is associate technical director of Kendall Co. Research and Engineering. He has been married to Trudy since 1967 ("the best decision of my life") and is an international rugby referee. . . . **Paul Liao** is at Bellcore, where he is division manager for photonics science and technology research. . . . Well, we've heard from two of my former Burton House dormmates this month. Who else is out there?—**Jeff Kenton,** Secretary, 7 Hill Top Rd., Weston, MA 02193

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Tom Sharon has been promoted to president and chief operating officer of Electromagnetic Sciences, Inc. in Norcross, Ga. . . . Last year **John Howard** joined Davis & Geck, a surgical supply firm in Danbury, Conn., where he is redesigning the company's manufacturing machinery. He previously worked at Chesebrough-Ponds in Shelton. . . . **Michael Zuteck** has designed the wing structure and sug-

gested a new airfoil for a new aerobatic airplane design to compete in the 1988 world championships. Look for the names of Henry Haign and Harold Chappell, who qualified second and fourth on the U.S. team of five. Mike has also collaborated on a design of new Formula 40 racing trimaran. (Mike forwarded some information on the design—if you would like a copy, contact me.) He also notes that his private speed sailing project has now attained about 24 knots on its march to the world record of 28 knots in the "B" class. In addition, Mike is involved in a high profile wind turbine blade failure controversy. (Additional information about this project is also available.)—**Jim Swanson,** Secretary, 878 Hoffman Terr., Los Altos, CA 94022

68 20th Reunion

By the time you read this, you should be packing your bags and heading for our gala 20th Reunion. If you don't know what we're talking about, please call us immediately for details.

Rachel Samantha Schiff, daughter of **Andrew (Friedland) Schiff,** was born on August 15, 1986. Andrew reports that they have recently moved from Manhattan to Harrison, N.Y., where he is enjoying all the "typical homeowner delights such as yardwork, home repairs, etc." . . . **Dan Green** now has a second daughter, Sara Anne, who was born on December 4, 1987. Dan recently finished writing a book: *Long Term Complications of Therapy for Cancer in Children and Adolescents.*

Boston's November 12 blizzard resulted in an unscheduled visit by **Paul Gluck** to M.I.T. He had planned to stay at the new Mariott in Kendall Square, but the chaos resulted in no room at the inn. He was then transferred to the Hyatt (near B.U. Bridge), requiring a walk through the sacred grey hallways—his first in ten years—to get to his meetings. He finally found the Coop at its new location. (Those of you who have not been in Cambridge for a while and come to the reunion should keep track of how long it takes you to find it.) Paul comments, "Wow, have things changed! Yet the Great Court, cloaked in mid-November snow, looked hauntingly familiar and reminded me of why I moved to Florida." . . . **Gary Anderson** has relocated to Greensboro, N.C., where he is self-employed as a builder and developer of industrial property. . . . From L.A., we hear that **Ray Paret** works in the entertainment industry and is looking forward to the reunion. If you're passing through L.A. he welcomes calls.—**Gail & Mike Marcus,** Secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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I have the sad duty to inform you that our classmate **Joseph W. Kennedy** died on January 4, 1988, at the University of Massachussetts Medical Center, Worcester, after a long illness. Joseph had been a resident of Sutton, Mass., since 1974, and for the last three years was owner of Kennedy Associates in Sutton, a technical writing consulting firm. Previously he was manager of hardware documentation in the information systems division of Data General Corp., Westborough, for 12 years. At M.I.T., Joseph was a physics major and a Burton House resident. He went on to Boston University to receive a master's degree in physics and astronomy. I'm sure I express all our feelings in offering condolences to his wife, Anne, and family by saying that the man who loved the stars has returned to them in peace.

Don J. Lapenas, a specialist in internal medicine, has been appointed to the medical staff at Central Maine Medical Center in Lewiston. Don lives in Auburn, Me., with his wife, Lydia, and practices with Mt. David Clinical Associates in Lewiston. . . . Aero/Astro'er, **James R. Yankaskas** writes, "My wife Bonnie (Simmons '67) and I live in Chapel Hill, N.C., 'the southern part of heaven.' I am a pulmonologist/internist at the University of North Carolina and study the physiology of airway epithelial cells. Flying is still an avid hobby—am now licensed as an Airline Transport Pilot, and fly to many meetings and vacations. Running has new rewards after the age of 40, i.e., winning my age category."

Mark J. Mathis continues as vice-president and general counsel of the Chesapeake and Potomac Telephone Companies of D.C., Va., Md., and W.Va. He is now also associate general counsel of Bell Atlantic, with responsibility for supervising litigation before the F.C.C. and Judge Greene's divestiture court. . . . Pittsburgh resident **Joe Horton** writes, "I'm now on part of a much-needed sabbatical, partly in San Diego, partly San Francisco. Amazing how different they are from Pittsburgh! Doing research on blood flow in aneurysm models and balloon treatment of aneurysms in my arcane subspecialty of surgical neuroangiography. It's the ultimate video game and has the highest stakes: you and your patient can't put in 25 cents and get an extra life—only one."—**Eugene F. Mallove,** 183 Woodhill-Hooksett Rd., Box, NH 03301

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Cynthia Bloomquist was recently appointed associate director of the M.I.T. Industrial Liaison Program and will assume full responsibility for the Program's marketing activities. She will also work on coordinating developmental efforts and increasing I.L.P. memberships. Previously, she was assistant director of M.I.T. admissions; she has been with I.L.P. since 1974. She is completing her M.B.A. at Northeastern University. . . . **Steven Girshick** lives in Minneapolis and is in his third year as assistant professor of mechanical engineering at the University of Minnesota. His wife, Nora, recently published some short stories. They have two daughters. . . . **Joseph Kubit** recently moved to Cleveland, Ohio, and assumed duties as general manager of long-range planning at the M.A. Hanna Co. He is active in the M.I.T. of Cleveland Alumni Group.

Julia Anne Norton is professor of statistics at California State University at Hayward. Her husband, John, is professor of psychology at the same university, and they have three children. The whole family expects to attend the 25th Reunion. . . . **Robert Lewis** is special counsel in the Division of Investment Management, Office of Insurance Products and Legal Compliance at the S.E.C. He previously served as special counsel in the Office of Public Utility Regulation. He is active in local Jewish community affairs as an officer and participant, and writes that he is still single and enjoying Washington, D.C. . . . **David Dobkin,** professor of computer science at Princeton University, is involved in the Geometry Supercomputer Project, which uses a super computer and high-speed telecommunications network to link 13 leading mathematicians in the United States and Europe in order to solve basic problems in geometry.—**Robert Vegeler,** Secretary, Beers, Mallers, Backs, Salin and Larmore, 2200 Ft. Wayne Bnk. Bldg., Ft. Wayne, IN 46802

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Jeffrey B. Satinover is executive director of the Sterling Institute for Neuropsychiatry and Behavioral Medicine in Stamford, Conn. He is a Yale-trained psychiatrist and former Burroughs Wellcome Fellow of the American Psychiatric Association, with degrees from Harvard, the University of Texas, Yale, and M.I.T. He has been medical director of the Temenos Institute and is on the attending staff of Stamford Hospital. He is active in research on the brain electrophysiology of psychiatric disorders. . . . **Daniel E. Bloom** is enjoying his new job, doing a great deal of cycling, returning to dance and music, working to preserve abandoned railways, having a ball in eastern New England, and wondering what became of Moose. . . . **Robert Pepper** is busy with the toy store and playground equipment business that he and his wife, B.G., run. They had their third child, Daniel, last June.

Marc Alpert has a new daughter, Leslie Ellen, born November 3, 1987. He is a member of the Delaware Valley Vascular Society and the Eastern Vascular Society. . . . **Donald Haurin** was named assistant dean of the College of Social and Behavioral Sciences at Ohio State University and is co-editor of the *Journal of the American Real Estate and Urban Economics Association.* . . . **Peter Stoll** returned to Intel in April, 1987, where he is trying to push more 80386s out the door. It is the closest he has gotten to manufacturing in a design career. He designed a water fabrication factory in Jerusalem and had the opportunity to visit it last November.—**R. Hall Moorman,** Secretary, P.O. Box 1808, Brenham, TX 77833

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Craig Lewis is practicing internal medicine in Yap of the newly Federated States of Micronesia. He plans to live there another two years before returning to set up a practice in rural New England.

We have a glorious note written on an Alumni Fund contribution, but unfortunately there is no signature: "My wife Alison (Wellesley, '77) and I had our first baby, Sara Deniz, last May. She is our joy and happiness. Alison is returning to her job as a Manhattan district attorney after seven months off. I am now a partner at the investment management firm of Charter Atlantic Corp. in New York. Being strictly a bond firm, we have escaped the Black Monday Crash and are still having much fun in the markets." Please write and let us know who you are.

After a Ph.D. in 1981 and an M.D. in 1983 from the University of Chicago, **James Adamson** is a resident in neurosurgery at Mt. Sinai Hospital in New York. . . . **David Millman** received an M.B.A. from the University of Pennsylvania's Wharton School in May 1986. He now works for Environmental Resources Management, Inc. in Exton, Pa., as an environmental consultant.

Robert Goodof writes, "I'm a securities analyst with Eaton Vance Managment specializing in chemical and microcomputer related stocks and industry dynamics. Until October, it beat working for a living, although it's still an active and challenging career. I'm still goal tending, playing fast pitch softball, cycling, and skiing to fill the time."—**Dick Fletcher,** Secretary, 135 West St., Braintree, MA 02184

73 15th Reunion

Chris Tavares is trying to fill the void of the M.I.T. Rocket Society by starting another, this one near his home in Northboro, Mass. Other old Tech rocketers can contact him for a list of planned events. . . . **William Bron** has worked in Mexico and Costa Rica; he is now in the corporate finance department of Drexel Burnham in L.A., doing leveraged buyouts and public offerings. . . . **Rich Charpie** is a managing general partner at PaineWebber in Boston. . . . **Jim Silverman** is in his native Pittsburgh as an employee benefits consultant with Touche Ross. . . . **John Breen** writes that he has left the consumer products division of Kodak in Rochester to join Bose in Framingham. John, wife Wendy, and sons Chris (9) and Todd (5) are still getting the boxes unpacked.

Yours sadly had a conversation a few days ago with the secretary of the Class of '76 regarding the unfortunate passing of our mutual friend Erland van Lidth de Jeude, '76. I'd appreciate it if any of his friends from '73 would check his class column for news of a fund for his baby son's education. Many of our own class from the Musical Theatre Guild, the wrestling team, and so

forth have Erland stories and in his memory, would probably like to make an appropriate gesture.—**Robert M. O. Sutton, Sr.,** Secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

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The news from **Richard Granstein** is short and to the point: he has been married to the former Ilene Siegal, and they are expecting a baby momentarily. . . . **Gary Raymond** reports that his software company has been selling some products to Japan, Korea, and Singapore. "I think U.S.A. software engineering is still tops in the world. M.I.T. did its part in helping this to happen—at least for me," says Gary. . . . "I am now a lawyer in the commercial litigation section of Lemle, Kelleher, et al in New Orleans," writes **Larry DaGate.** "Some of my work is bankruptcy or workout related." . . . **Anthony Shields** is a faculty member at the University of Washington, doing cancer research. He and his wife, Faith Yoshimura, enjoy watching 15-month-old Ryan as he grows up. . . . Jan and **Bob Gahl** have been married for 10 years, and have an 8-year-old daughter and twin 6-year-old sons. Bob is very busy in his practice as a family physician in Two Rivers, Wisc. He recently passed his re-certification exam for the American Board of Family Practice.

Jeffrey Rosner sums up his news since 1983: Jeff bought a "fixer-upper" house in Palo Alto with his then-future wife Ronda. They remodeled, added more space, and then came the kids—Ari is 3, Sonia is 18 months. Jeff attended Stanford grad school for his M.S. and Ph.D. in materials science, all the while keeping the day job at Hewlett-Packard. To sum up in a word, Jeff says, "Whew!" . . . **Seth Powsner** married Elizabeth Yen in August, 1985. Seth is on the Yale Medical School faculty in the Psychiatry Department. He crossed paths with **Larry Segil** at a recent American Heart Association meeting, where they were both presenting papers on cardiac ultrasound contrast agents. . . . **Paul Moroney** and his wife just had their second child, a boy, in October.—**Lionel Goulet,** Secretary, 115 Albemarle Rd., Waltham, MA 02154

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William W. Rowe is in his third, and hopefully final, year of cardiology training in North Carolina. He hopes to return to Anchorage, Alaska, to set up a private practice this summer. . . . **Robert W. Mann, Jr.,** writes, "Corporate life in a consolidating industry continues to be interesting, yet presents its share of opportunities. My wife, Susan, and I celebrated our first anniversary to the accompaniment of three attempted take-overs of Pan Am. My start-up firm, Airline Automation, Inc., has repositioned itself as a provider of proprietary schedule and distribution systems for the airline industry. Both companies went profitable." . . . **Carol Livingstone** writes that she and her husband, Dan Grayson, Ph.D. '76, had a second child last June—a boy, David Edward Grayson. They have an older son, Paul (7). Carol heads the Division of Management Information at the University of Illinois. She is also campus director for the implementation of a new human resources management system. Dan is associate professor of mathematics and a Beckmann Associate for the 1987-88 year. Says Carol, "We both are thrilled with the new baby who is, by the way, just the most pleasant child ever."

From the *Standard-Times* of New Bedford, Mass., we learn that **Dean Edwin Calcagni** is now at Fort Detrick, Md., for duty with the Army Medical Research and Development Command as a combat casualty research manager. He was promoted to Major while serving as chief of anaesthesia and operative service with the 5th General Hospital in West Germany. . . . From the *Times-Record* of Brunswick, Maine: Air Force Major **Brenda J. Schilinski** has been awarded the Air Force Meritorious Service Medal by the director of the Defense Mapping Agency. Brenda is a weapons system support manager in the Agency's research and engineering directorate. . . . **Michael S. Cucchissi** became a founding partner of Pettis, Tester, Krause and Krinski in April, 1987. Formerly he was a partner with the Newport Beach office of Gibson, Dunn and Grutcher, which he joined in 1979 after serving as judicial clerk to Chief Judge Samuel P. Ping of the U.S. District Court of Hawaii. He specializes in real estate development and financing law. He and his wife, Barbara, live in El Toro, Calif., with their two children.—**Jennifer Gordon,** Secretary, Pennie and Edmonds, 1155 Avenue of the Americas, New York, 10036; or 18 Montgomery Pl., Brooklyn, N. Y. 11215

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A short, partly cryptic, note comes from **Marvin Bugg:** "Daughter Emily was born on February 19. Bryan is now almost 5. Still working at Monsanto Agricultural Co. Please say 'hi' to Slow Death." . . . From **Peter Okin:** "Remaining at Cornell Medical College as assistant professor of medicine in division of Cardiology. Living in New York City with wife, Lisa (full-time in Department of Neurology at Sloan-Kettering), son Daniel (3), and another child due at Christmas." . . . **David August** writes, "All is well. I was recently promoted to become an assistant professor of surgery at Yale, and I continue my research in surgical oncology. For New Year's Eve, I went to Talbot House with Bonny Kellerman, '72, Dan Bloom, '72, and a bunch of old reliables." . . . **Daniel Jablonski** has "been married for five years, has a 2-year-old son, and works for the Superconducting Research Center in Lanham, Md. I also teach circuit design as an adjunct professor at a local technical college." . . . **Reynold Lewke** has finished "M.B.A. at N.Y.U. in July, 1987. Wife and I enjoying weekends off. New daughter, Brianna Virginia, born on September 30. Son, Brandon (2), will carry on at M.I.T. while daughter carries on mother's activities at Wellesley, assuming the stock market crash will result in affordable tuition by then."

Ann and **Andy Hawryluk** "moved out to Modesto, Calif., in 1983, after Ann finished her pediatric residency. She is now a member of a large group practice with roughly 100 physicians and six pediatricians. Her practice is going 'too well,' which means she works long hours. I (Andy) began working at the Lawrence Livermore National Laboratory at the same time, and have been involved with the application of microfabrication techniques to x-ray optics, for which I have received two IR-100 Awards during the last two years. I am looking into expanding the uses of microfabrication to other areas, some of which are medically related, others more closely related to the integrated circuit industry. All this is 'fun' for both Ann and myself, but our real joy comes from spending time with our daughter, Amy (2). What little free time we have is spent trying to relax, catching up on sleep, and doing athletic activities. We still play lots of tennis, which takes up much of our minimal amounts of free time. We plan to make a trip to the East Coast during this summer, and hopefully will look up some old friends when we do."

As for your secretary, he continues to see amazing moves in bonds, gold, foreign exchange, and stock index futures. The post-crash environment remains extremely volatile and nervous. My brokerage firm continues to flourish, adding mixture of hedge and speculative clients. Because of business growth, we took over an entire floor in a building formerly used as a garment manufacturing loft. On the family front, all is reasonably well, as we all have managed to survive a nasty bout of February flu together. . . . I have received a limited response to the news of **Erland van Lidth de Jeude's** untimely death, and I am sending a letter to all those who have written for details for a trust for Erland's son, Christaan. If you are interested and have not written, please do write.—**Arthur J. Carp,** Secretary, Stalco Futures, Inc., 254 W. 35th St., 16th Floor, NY, NY 10001

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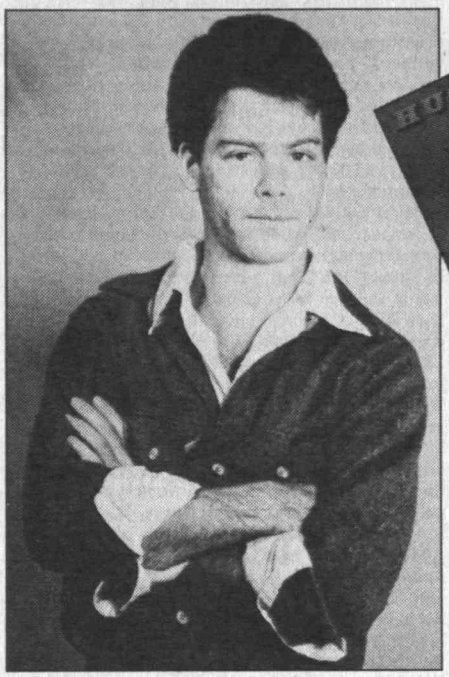
Hearty congratulations to our former class secretary-treasurer, **Barbara Crane,** and her husband, Mark, '76, on the birth of their son. Barbara sends the news that Sean Thomas Crane was born on December 9, 1987. Barbara also sends the last few notes which she received as secretary. . . . Linda and **Mike Atlas** of Arlington, Mass., had a son, Robert Phillip, on August 9, 1987. . . . **K. Eric Drexler** is a visiting scholar at Stanford while maintaining his position as research affiliate at M.I.T.'s Artificial Intelligence Lab, where in 1985 he founded the M.I.T. Nanotechnology Study Group. His book on nanotechnology, *Engines of Creation,* is doing well and was scheduled to be published in paperback in September, 1987. He also lectures extensively on the topic to academic, industry, and general audiences. . . . **Randy Wilson,** who has been in California since graduating, has been busy and successful in Los Angeles in the entertainment industry. Randy moved from working in gas stations and mailrooms to eventually writing and producing several first-run syndication television shows, as well as some episodes of network sitcoms, most notably "Silver Spoons." Randy is currently director of development for a new production company and has been involved in the creation, writing, and production of many movies and television mini-series. He has also completed a novel which he is trying to get published. Randy continues to be in touch with some of his fraternity brothers in California. He attended the wedding of **Peter Kwon** several years ago; Peter is now a physician at Cedar's Sinai in Los Angeles. Randy is still single, lives 50 feet from the beach, and hopes we'll all be seeing more of his name on TV and movie screens everywhere.

Jerry Landau lives in Warren, Pa., works for United Refining, and is building an earth-sheltered house. He reports that his new job title, "engineering manager," carries with it more work, more responsibility, but, alas, the same pay. He is on the verge of becoming co-owner of a natural foods store and cafe. In his spare time, Jerry teaches yoga and a vegetarian cooking class. . . . As director of Bradley Observatory at Agnes Scott College in Atlanta, **Alberto C. Sadun** is upgrading the 30-inch telescope with state-of-the-art detector technology and is moving it to a dark site away from the city. "Although a formidable and challenging task," he writes, "I am very excited in being involved in creating what should become an outstanding observatory in the East." . . . **Tod Glickman** was expecting to receive his M.B.A. from Suffolk University's Executive M.B.A. program in March. He recently recommended the appointment of **Yolanda Hinton** to Technology Broadcasting Corp. (the licensee of M.I.T.'s WMBR Radio). Todd is now in his second year as the corporation's president. He notices that freshmen seem to get younger all the time.

Stephen Cecchetti, on leave from N.Y.U. Business School, is on the faculty of Ohio State University. He received his Ph.D. in economics from U.C. Berkeley in 1982. He and his wife, Ruth Charney, were married in 1986. They had a son, Daniel, in April, 1987. Ruth is a member of the Math Department at Ohio State. . . . **Norm Speciner** has been with Camex in Boston for five years, and he is now a product manager. He finds life hectic and interesting with two daughters—3-year-old Lauren Joy and 7-month-old Stephanie Hope. They live in Medway. . . . **Robert K. Desai** moved from Buffalo to Solon, Ohio, and works at the Cleveland Clinic Foundation in the Department of Radiology. . . . **Elliot Lach** dropped a line from Worcester, where he is

More News From the Interface of Art and Science

By Debra Cash





Hugh Blumenfeld, '80, teaches literature and writing at the University of Connecticut at Storrs. His first album,* The Strong in Spirit, *a collection of folk songs, has been released this year by Grace Avenue Records.

Hugh Blumenfeld, '80, sees many similarities between the painstaking work of science and songwriting. Both begin with a kernel of inspiration and develop structures that, at their best, combine surprise with a feeling of inevitability, and both attempt to encode meaning in beauty.

Blumenfeld's comparisons between the worlds of the biologist and the musician come easily: he has lived in both. After he graduated from M.I.T. with a combined degree in biology and literature, he refocused his sights on graduate work in English.

He has remained in academia, teaching literature and writing at the University of Connecticut at Storrs and preparing a Ph.D. dissertation that, he says, explores how William Blake, armed with his own cosmology, took on Newtonian physics. But along the way, Blumenfeld found himself in Greenwich Village with a guitar on his knee, a folksinger.

The strong in spirit sing their songs in darkness
*They sing even in darkness**

The urge to write songs, "returning to the oral quality of poetry," didn't hit him in earnest until late in 1982. A fledgling folk music revival was on, after a brief hibernation during the disco decade. Blumenfeld, with his light tenor and crisp fingerpicking style, started performing at the open mike nights at the Speakeasy Musicians' Cooperative. His own songs traced family dynamics, yearned for love, and even, in one case, compared the gentrification of the Upper West Side of Manhattan to creeping apartheid. Jack Hardy's *Fast Folk Musical Magazine,* practically an anthology on vinyl, scouted those events for the best in undiscovered acoustic music; soon Blumenfeld was counted among the "fast folkies" and the musicians of the Cornelia Street Songwriters' Exchange, who were duty bound to present a new song to each other every single week and "felt bad if they didn't come up with 50 songs a year."

Blumenfeld eventually began performing more regularly, opening for a number of folk acts up and down the Eastern seaboard—and this year he cut a record, *The Strong in Spirit*. "I'm not sure if I'm more at home with songwriters or engineers, although I certainly don't prefer literary critics," Blumenfeld chuckles. "The songwriting—not the performing—is what's important to me. It's a difficult business. There are only a few songwriters who write noncommercial music for other people to sing and can do it without giving up any of their integrity."

Blumenfeld distributes his record himself, out of the Connecticut house built before the American Revolution that he shares with his wife, attorney Andrea Gaines. He manages his record company, Grace Avenue Records, from a small room in the back.

"I once gave a lecture on metaphors and equations," he remembers. "I talked about the ambiguity of symbolic representations, the fact that mass meant something different to Newton than it did to Einstein and the people who came after Einstein. The process of mathematical condensation is very similar to the condensation of poetry, and both [scientists and poets] look for elegance of expression. What I was ultimately suggesting was the possibility of an exact poetics that reflects the world in no less of a correct way than scientific expression does."

It's this concern with the crossroads of science and art that gives Blumenfeld his own perspective on M.I.T.'s current attempts to bring the humanities more fully into the undergraduate curriculum. "The reason to study poetry and literature and music is that these things have their own logic," he observes. "They confront you with other ways of thinking, other languages."

Get the word from brother sun and you're dancing in the light
Get the word from sister moon running naked in the night
Get the word, get it any way you can
*Oh that's the only thing I understand.**

*Lyrics by Hugh Blumenfeld ©1987 Lark and Wild Thyme Music, BMI. Reprinted with permission.

DEBRA CASH is a frequent contributor to Technology Review.

PHOTO: THOM WOLKE

stant professor of Plastic Surgery at the U. Mass. Medical Center.

I was happy to discover that one of the junior high students in the church youth group I advise is a nephew of Mark Sneeringer, '76. It's a small world!—**Ninamarie Maragioglio,** Secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153

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Daniel Kahn writes from Israel, where he has been living since graduation, "I studied Judaism at the Pardes Institute in Jerusalem. Pardes is a school where English-speaking college graduates, with little or no background in Judaism, can study the traditional sources. I found it fascinating, and since then I have been observant of Jewish law. Later I studied for an M.B.A. at Hebrew University in Jerusalem. I am now working as an economic analyst for the Dead Sea Works in BeerSheva. In 1985, I married Joan Teitelbaum (State University of New York at Buffalo, '80), and we have a son named Yair Yosef. Earlier this year, I was drafted into the Israeli Army for four months. I was trained in infantry and mines. I will now have to do a month of reserve duty each year, and pray for peace so we won't need these skills." . . . **Jeff Dugal** drops a line from Coventry, England—a picture postcard of a statue of Lady Godiva. He writes, "I married Lisa Feigen (Carnegie-Mellon) on Halloween. She still lives near D.C., and I'm still in Williamsburg, Va., but we're both looking to relocate. I'm in England considering a plant manager position, and we had a chance to see the real lady of engineer song fame. There is also a Lady Godiva clock with a Peeping Tom on one of the adjacent buildings."

Philip Stein writes, "After finishing my N.I.H. postdoc at Harvard, I've moved on to Princeton, N.J., and am working for E.R. Squibb and Sons in the Chemistry Department as a research investigator. We're on the trail of new cardiovascular drugs." . . . From **Ken Murphy:** "My anesthesiology residency is now half over—finishing up in summer of 1989. Will be in Boston for a pediatric anesthesia elective beginning in January 1989. See some of you then!" . . . **Stephen Estes-Smargiassi** reports, "I've left the private environmental consulting field to return to the public sector. I'm now senior program manager for the new Long Range Water Supply Program at the Massachusetts Water Resources Authority. My short-term goal is to report credible progress to our board of directors and the public in reducing demand for water by December 1989. M.I.T. is well represented at the Authority—from the director to several new staff engineers. I'm still living in Jamaica Plain and keeping in touch with old roommates."

Laura (Rees) Willett has joined the staff of M.I.T.'s Health Service in internal medicine (as she describes it, "returning back home"). Her husband, **Bob Willett,** continues to work on his Ph.D. in solid-state physics.

I have had the pleasure of seeing some alumni lately. We spent New Year's Eve with Arnie and Lori (Ullman) Herman, '81, at their home in Stoughton, Mass. At the wedding of my best friend from high school last month, I ran into her first cousin, Jesse Abraham, '77. And on a recent business trip to Washington, I got together with Caren Penso, '77, and **Joan Sienkiewicz.** Joan is still with Electric Boat (a division of General Dynamics) but has relocated from their headquarters in Groton, Conn., to the D.C. area. That doesn't prevent her from spending half her work-week in Groton, which means she spends many hours waiting in airports. Joan keeps in touch with **Sue Burzyk** (who works for Polaroid in Wellesley, Mass.) and her husband **Dave Boccuti; Patrice Tyrell,** who is with Intel in Portland, Oregon; and **Paul and Audrey (Greenhill) Lones,** who were most recently in Singapore.—**Sharon Lowenheim,** Secretary, 303 E. 83 St., Apt. 24F, New York, NY 10028

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With the Greater Boston area still recovering from our latest snowfall, it's hard to believe it's already time to write up the news for May-June.

Barbara Johnston writes that she changed jobs in March 1987. She is now working for Land Management Group, Inc., a real estate development firm. Most of their properties are located in Woodbridge, Va. Since they have been following the premise that commercial development follows residential, they will soon find out if the Washington, D.C., area is recession-proof. . . . **Tabetha (Frey) McCartney** was expecting her second child in December to join Kyla, who was then 3 1/2. With her brother Karl, '83, and their respective spouses, she bought a summer "gingerbread" house on Martha's Vineyard, which they are now renting out for the summer '88 season. Tabetha currently lives in Newton, Mass. . . . **Arthur Hee** spent last summer on a business trip working with software firms in Taiwan, Japan, and Korea. He works for Mosaic Software in Cambridge.

David Zolla worked for Exxon International until August 1987, when he left to start his own consulting/software development company, Ram Dynamics, Inc. They advertised in the January issue of the *Wall Street Computer Review.* David has been happily married since August 1986. . . . **Andrea White** graduated from Catholic University Law School in January 1987 and has been promoted to project manager at the George Hymwn Construction Co. . . . **Gwen Freeman** is still a postdoctoral fellow in the Chemistry Department at Johns Hopkins University, although she has started to look for another job. She is also a pilot. She stays in touch with Alanna Connors, '78, and Larry Loomis, '81, who are in the Baltimore/Washington area.

Marriage (and related) news: **Nolan Kagetsu** married Nivin Pei, '79, last June 27 in New York City. Numerous M.I.T. alumni attended the wedding, including class of '80ers **Clarence Holmes, Namir Kassim,** and **Meeta Vyas.** Nolan is in his fourth and last year of radiology residency at St. Luke's/Roosevelt Hospital in Manhattan. In July 1988, he will begin a two-year fellowship in neuroradiology at N.Y.U. Medical Center. Niven works for Pfizer Pharmaceuticals in production planning and inventory control at their Manhattan headquarters. . . . **Jeff Goldberger** recently married Dr. Sharon Goldberger (she already had the same last name?!) and they now live in San Francisco where Jeff is a cardiology fellow at U.C.S.F. . . . **Kim Zaugg** got engaged on Christmas 1986 to Alan Vayda, who some of you may remember from our reunion. No wedding date has yet been set. Alan is working on his Ph.D. at Purdue while Kim continues to work at Penn State. . . . **Jeff Jaycox** moved to Washington, D.C., last year after he got married to Karen. He is currently a sales engineer for Analog Design Tools, covering the mid-Atlantic states, and says it is very exciting. The company sells computer aided engineering tools for analog circuit design.

Stephen McNamara graduated from the University of Connecticut School of Law in 1986 and is now practicing as an intellectual property lawyer at St. Onge, Steward, Johnston & Reems in Stamford, Conn. . . . **Bruce Allen** is now a research assistant professor of physics at Tufts. He just got back from a year in Paris, and he's received a grant from the National Science Foundation for work on early universe cosmology. . . . **Tim Morgenthaler** is still working as a diving medicine specialist for the navy in Hawaii but will be returning to the mainland to complete his internal medicine residency training in June. His wife, Robin, and 2-year-old daughter, Sarah, are loving Hawaii, and it will be hard for them all to leave!

Far from Hawaii, **Cindy Reedy** is now teaching chemistry and earth science in . . . Maine. (Well, face it, you can't get much further from Hawaii and still be in the U.S.) She is also freshman class advisor and coaches cross-country, aerobics, and track at Hebron Academy in Hebron. She lives on campus with her husband Brad Cummings, a native of Norway, Maine, a nearby town. (In fact, the news came straight from the *Advertiser Democrat,* Norway's newspaper.) . . . Also in academia is **Michael Gennert,** who was recently appointed assistant professor of computer science at Worcester Polytechnic Institute. His areas of interest include image processing, image understanding, and artificial intelligence. Mike had worked for PAR Technology Corp. in New Hartford, N.Y., after graduating from M.I.T. and then returned to M.I.T. for his Sc.D. in electrical engineering and computer science, which he received last summer.

I received a little note that **Emerson Yearwood** had graduated from Yale University and is now working in Washington, D.C. No further detail was provided. . . . I also received a nice long Christmas letter from Mike, '79, and **Diane Patrick,** who, as I've noted previously, recently deserted the fine condominium building we all lived in in Cambridge for the country—Assonet, Mass., to be specific. (I'm not sure if I had that right last time.) Assonet is about 45 miles south of Boston. Diane is practicing at the Truesdale Clinic in Fall River, where she is very happy and very busy. Mike gave up the hour-long commute into Boston recently and now works as the director of engineering at Cryptall L.P. in Cranston, R.I. The firm is a start-up manufacturer of encryption devices for the financial and commercial markets that currently employs only 15 people. The Patricks were recently somewhat surprised, but happy, to learn that they are expecting their first child in July.

Lots of news this month—huh? YOU could make the difference next month! Looking forward to hearing from anyone and everyone.—**Kate Mulroney,** Secretary, 256 Hampshire Street, No. 3, Cambridge, MA 02139

81

Hello everybody. It is hard to believe that I am composing the column for the May/June issue of the *Review* in the midst of a February blizzard. I certainly look forward to receiving this issue—and May!!

The "missing classmates" file has started to yield results. We have located **Doug Savage** in Wellington, New Zealand, where he is working on a consulting assignment project for Booz-Allen Hamilton. That's one good way to beat the snow, escape to summer in the southern hemisphere. He'll have returned to his home in Dallas by the time this column appears.

Tony von Ruden writes that he is working as a software engineer at UltraTech Stepper, a part of Up and Over Engineering, a company founded by John Castellano, '80. Tony reports that he and his wife Michelle moved from their small apartment in Palo Alto to a wonderful little cottage in the woods behind Stanford University. . . . **Steve Fairbairn** is living and working for the U.S. Air Force in Idaho. Steve just finished up a four-year tour flying F-111s at RAF Lakenheath. He has been reassigned stateside to be an instructor pilot at Mountain Home Air Force Base where his job is to transition pilots to the F-111 enroute to overseas assignments. Steve is happily married to the former Margaret Walsh and reports that they are hoping to start a family soon.

Guy Vachon reports that he is alive and well in Austin, Tex., where he is busy bowling, golfing, and taking care of his two kids, Carolyn and Guy Pierre (who he hopes will be classes of '05 and '06 respectively). Guy was recently promoted to senior project engineer and claims to have an interesting article appearing in the publication, *Color Research and Applications.*

A clipping from the *Middlesex* (Mass.) *News* reports that **Avi Benatar** recently joined the Department of Welding Engineering at Ohio State University. . . . **Jeremy Barkan** has been living in Israel since graduation. He earned a master's in

chemical physics from the Weizmann Institute and has been consulting to several software companies. Jeremy has seen several fellow M.I.T. Jerusalemites, including Avery Lamper, '82, and his wife Cheryl Walker, '84, David Goldfarb, '84, and his wife, Heidi Brun, '83.

That's all for this month. Please keep the letters and requests for missing classmates coming.—**Lynn Radlauer Lubell,** Secretary, 216 Beacon St., Boston, MA 02116

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Believe it or not, some of us haven't left M.I.T. **Whay Lee** is still at the Tute working on his Ph.D. in electrical engineering and computer science. He has been living in Ashdown House all this time and became chairman of the Ashdown House executive committee, which received the Edward Horton Fellowship Award for fostering fellowship within the graduate student body. Whey also received the Avery Ashdown Award for his efforts in originating and organizing the Ashdown Colloquia on Technology and Society.

Some of us have left M.I.T. but are still students. **Doug McMahon** describes himself as an unemployed and impoverished graduate student pursuing an M.B.A. at the University of Virginia. . . . **Nancy Huelsmann** is pursuing a master's degree in engineering management at Santa Clara University while working as a components engineering manager at Hewlett-Packard. . . . **Barrie Trinkle** has returned to school to get a master's in aeronautical engineering at the University of Colorado; she is also doing research at the Colorado Center for Astrodynamic Research. Before that, Barrie spent five years at the Jet Propulsion Laboratory. She reports that Boulder must be the real hub of the universe, as she ran into three Jack Floreyites in her first three months there.

Some are still at school but are not exactly students. **Mark Hurle** received his Ph.D. in chemistry from Penn State and is doing postdoctoral research at the University of California at San Francisco. . . . **Ben Wise** is enjoying life in Vermont as a Dartmouth professor. He and his wife, Kim, have one daughter, Marlisa.

Reports from the world of medicine. **Judith Badner** should be getting her Ph.D. just about now and will finish her last two years of medical school at the University of Pittsburgh beginning in August. She has been studying the inheritance of Hirschsprung Disease. . . . **Peter Bernhardt** is finishing his second year of residency at Duke University Medical Center. Peter and his wife of three years, Ellen, have a son—Zachary was born on Valentine's Day, 1987. . . . **Jeffrey Lukas** is finishing his second year of pediatrics residency at the University of Connecticut Health Center in Farmington, Conn.

Reports from the military front. After being discharged from the navy as a lieutenant last July, **Michael Post** spent three months as a professional beach bum in Virginia and three months as a professional ski bum in Colorado. Since January, he has been working as an electrical engineer in Westinghouse Electric's Machinery Technology Division in Pittsburgh. . . . Supplementing last month's report about **Doug Thayer** and **Joan Purdy-Thayer,** Doug writes to say that Joan is flying T-39s in North Island, having finished a tour as an instructor in the Navy Jet Training Command flying A-4s. Doug is on his second overseas tour, still flying A-4Ms for the Marine Corps. They have one boy, Nathaniel Harlan. . . . **Cynthia Ann Hale Strong** is working for the General Dynamics Land Systems Division to develop robotic combat vehicles; she's licensed to drive the 63-ton M1A1 main battle tank (hopefully not on the streets of Rochester, Mich.)

And last but not least, reports from the working world of engineering and management. **Eddie Torres** has been working at McKinsey & Co. for a little over a year, after leaving his previous job in Boston and spending five months doing nothing. Eddie reports that he still plays golf. . . . **Kent Massey** is the founder and president of a CAD and desktop publishing company which provides systems integration, consulting, and software development. His staff of nine includes two other M.I.T. grads. . . . **Patrick Houghton** is still living in Palo Alto, Calif., but left his job as an operations manager for American Rocket and is now government sales manager for Trimble Navigation. . . . **Patrick Bigot** has been working as a design engineer for Chevron in the San Francisco area since finishing his appointment at the M.I.T. Chemical Engineering Practice School last summer. . . . **Matthew Prete** resigned from the company where he'd worked for three years after the company was acquired by Lotus Development Corp. last year. He's currently finishing his bachelor's thesis and applying to business schools.

If you don't provide news, there won't be any class notes. Please take a moment to write or call East Coast correspondent **Linda Schaffir** (18 Prospect Ave., Apt. B-2, Norwalk, CT 06850), West Coast correspondent **Michelle Gabriel** (656 S. Fair Oaks Ave., D-211, Sunnyvale, CA 44086) or me.—**Stephanie Pollack,** 33 Trowbridge St., Cambridge, MA 02138

84

I am writing from SUNNY California, where it is 74 degrees on February 11—a very good time to visit. And I actually have some news to relay provided by the alumni association (who keep very good track of where you are, no matter how hard you try!).

David Schaeffer has accepted an associate's position at the New York City law firm of Morgan & Finnegan, where he will be practicing intellectual property law. . . . **Arunus Chesonis** writes that he "has been living in Rochester, N.Y., since graduation; two fraternity brothers from Sig Ep are also now in Rochester (**Steve Dubnic,** '84, and Shawn Retera, '83). Left Rochester Telephone this past May to become vice-president of operations for ACO Long Distance Corp. (also in Rochester.") . . . **Ron Rubenstein** says, "I am an M.D./Ph.D. candidate at the University of Texas Southeastern Medical in Dallas working on a dissertation in pharmacology." . . . **Jay Fridkis** says that he got married (congratulations!) on December 8, 1987, and is still in New York and still at AT&T. He saw **Mike Agronin** over Thanksgiving.

John Holcomb also got married last year (congratulations!) to Monica Sypien of Buena Park, Calif. He also says, "I was transferred to Washington, D.C., on August 24. I am currently assigned as an intern at the Capabilities Assessment Division; Force Structure, Resource and Assessment Directorate; Organization of the Joint Chiefs of Staff. I was promoted to lieutenant, U.S. Navy, on August 31." . . . **Preston Kemp, Jr.** writes that he was promoted to senior engineer this year and is still working on new products development. He was issued his first patent this year with seven more pending. . . . **Nancy Defeo** is doing research on the acid rain problem in the Northeast using satellite image. She works with the complex systems group at the University of New Hampshire.

Nora Ryan received her M.B.A. with a concentration in technical marketing from the University of San Francisco.

David Spiewak has been appointed commissioner of public works in Pittsfield, Mass. . . . **Douglas MacLean** has been appointed as a loan officer at Shawmut Worcester County Bank. . . . One final note: Someone wrote in to let us know that **Mark Hagemeister** married Deborah Carlucci on November 14, 1987, at Calvary Temple in Wayne, N.J. They will be living in Lawrenceville while Mark continues at Mobil Oil Co. after a honeymoon in Cancun. Congratulations to the two of you!

Thanks to everyone who wrote in, and remember to write in about yourself and your friends, when you get a chance!—**Mona Wan,** Secretary, 10480 Creston Dr., Los Altos, CA 94022

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Inge Gedo and Wayne Applewhite were married last January in West Germany. She hopes to come back to the U.S. soon but doesn't know when she'll have an opportunity to. . . . **Timothy McKenney** was deployed to the Indian Ocean until mid-January aboard the *U.S.S. Schofield FFG3.* . . . **Andy Weiss** is still working at KLA Instruments as a design engineer. He says he had a blast in Hawaii with his girlfriend.

Tom LeCompte received his M.S. in Physics from Northwestern University and hopes to complete his Ph.D. in 1990. His research is being conducted at the Fermi National Accelerator Laboratory. He is still playing trumpet professionally, currently with a 12-piece wedding band. . . . **Daniel Morgan** is still in physics grad school at the University of Texas at Austin. He gave his qualifying seminar last September. As soon as he gets around to some paperwork he'll be officially admitted to candidacy. He shares an apartment with Bill Saphir, '86, and an office with **Sam Cable.** . . . **Ed Derrick's** office is next door. He occasionally sees **Ali Alwattari** and Neil Woodward, '84, around campus, and met Chris Fitch, '84, passing through town. . . . **David Smith** visited last year as did **Jon Rochlis.**

Samuel Lafontaine is attending the Yale School of Organization and Management and is pursuing a master's on public and private management, which he will receive in 1989. . . . **Elisabeth Smela** received her master's in electrical engineering from the University of Pennsylvania last December. . . . **Yancy Dennis** is pursuing his Ph.D. in chemical engineering at the University of Virginia after receiving his master's from UVA a year ago. . . . **Joshua Makower** is completing his third year at NYU Medical School and is still playing music in the band "Still Trust." The band plays in the New York, New Jersey, and Boston areas and has just begun work on its first album. Suprisingly, the band's producer is also a recent graduate from M.I.T., Josh Israelsohn, '86. Although "Still Trust" has not had any bids from any major labels, they are all very hopeful. Good luck guys!—**Stephanie Winner,** Secretary, 1026 Live Oak Dr., Santa Clara, CA 95051

86

Aloha from sunny California! I received several letters this month. **Andy Stevens** worked at Bell Labs in Whippany, N.J., since the summer of '86. Bell liked Andy so much that they decided to send him to get his master's, all expenses paid. He finally completed his thesis in electrical engineering. His research involved designing a new CMOS integrated circuit for use in the new superconducting super collider. Andy has returned to Bell and is trying not to be labeled as a "Y" person (Doonesbury). . . . **Basil Ma** also works at Bell Labs in Whippany. He got his master's at the University of Southern California. . . . **Bobby Greenfeld** is at the University of Pennsylvania working for his master's in electrical engineering and bioengineering and should be out by May. . . . **Caroline Richardson** is with the Peace Corps in Lesotho, Africa, and **Steve Lentz** is working in Boston.

David Zagorski is getting married to **Scott Berkenblit's** younger sister, Shari Berkenblit, '88, in Valley Stream, N.Y., on August 20, 1988. They became engaged in Montreal. David started working at an engineering consulting firm in Andover, Mass., but got tired of engineering. He now works for Colonial Management Services, Inc. in Boston as a quantitative analyst. David ran into lieutenant **Greg Greeley** last August. Greg is working at the Pentagon and had an office not far from Caspar Weinberger before he retired. David also mentions that Mark Foringes, '87, will

be serving his ROTC commitment "somewhere near Kennedy Space Center"—Patrick AFB, I think.

Brian Latt is currently working for Laser Media in Los Angeles and will be operating the laser lighting effects for the upcoming George Michael world tour. First performance is Tokyo, followed by Australia, Europe, and the U.S.A. . . . **Lianna Cleland** is a first-year law school student at Yale (not at Computer Information Systems in Braintree). . . . **Paul Romanelli** is also at Yale working toward a Ph.D. in physics. . . . **Lieutenant Karen Getschow** is expecting a new addition to the family in April. She is working at Wright-Paterson AFB, Ohio, studying G-forces on the body.

Lieutenant **Rich Maurer** flew out to Norton AFB, Calif., from Reese AFB, Tex., on a training run for undergraduate pilot training for the air force. Rich graduates in April and will be stationed in New York. He stayed with lieutenant **Karl Tucker** while at Norton. Karl works for the Ballistic Missile Office there along with lieutenant **Mat Phelps** and lieutenant **Don Davidoff.** Karl got the lucky chance to see the Super Bowl live in San Diego. It turned out to be a good time after all as he is an avid Redskins fan.

Lieutenant **Sonya Sakai** became engaged in March 1988 to an Air Force Academy grad. They showed up at **Grace Tan's** surprise 24th birthday party in Pasadena given by Grace's sister Greer, '87. Among the throngs of people that attended were lieutenant **Greg Harrison** and Stacy Weinstein, '87. Greg is taking classes at the University of Southern California in aerospace engineering and is training for the 1988 Los Angeles Marathon to be run in March.

Craig German will be graduating from the University of Virginia with a master's in electrical engineering and plans to return to Boston. . . . **Megan Smith** is still at M.I.T. grad school working in Apple Computer's Vivarium Project with Woodie Flowers, associate professor of mechanical engineering. Her solar car team got ninth out of 24 in their Australian race earlier this year. . . . **Linda Muri** finished third in the club singles in the Head of the Charles held last October.

Karen Wohl wrote me from her sick bed. She was laid up for a while but by now should be using the ski house again on the weekends. **Anthony Scotti, Alan Hildebrand, Lenny Tender,** and TJ Craddick, '88, were there in early February. There was a reunion at the ski house over New Year's including Karen, **Ellen Epstein, Ray Brunsberg, Jim Egan,** and Jim Dana, '84. Karen says snowmobiling is amazing.

I heard from the final Ellen. **Anne Fricker** spent the Washington's Birthday weekend in Southern Calif. with me. We spent one day playing volleyball on the beach (with Rob Dare. '84) and one day in Tijuana. Anne says that **Mark Emineth** and **Dan Pyne** are still working in the Washington, D.C. area.

Keep up the good work. I'll catch ya'll next month.—**Mary E. Cox,** Secretary, SD/CLTPC, P.O. Box 92960, Los Angeles AFB, CA 90009-2960

87

It's Sunday night before Washington's Birthday, and I have to go to work tomorrow. Remember those four-day weekends at school? Aah, the good old days. The letters just started coming in with the January magazine's publication. Thanks so much, and please keep it coming.

Cheryl Larrivee wrote to me about the M.I.T. contingent in the Midwest. Cheryl and **Steve Levine** are working away at the University of Wisconsin, Madison. Cheryl is one of 34 grad students in the Chemical Engineering Department, and Steve is one of two grad students in the Astronomy Department. They say, "Madison is an okay city, but we miss the East Coast and Boston a whole lot. There's no decent Chinese food out here, and it's too cold (-30°, -40° F.)."

Hoi Man Siu is busily working for Proctor and Gamble in Cincinnati as an environmental engineer. Hoi has settled in well—he's taking Japanese and German at an area college. . . . **Steve Pasternak** is studying furiously at McGill University Medical School. He says he wishes he had more time to see the lovely city of Montreal. . . . **Sara Watkin** is at medical school, too—UCLA. She's enjoying Los Angeles and being closer to her family, but she also finds medical school consuming large amounts of time. . . . **Barbara Ex** is at Practice School (chemical engineering) at M.I.T. She'll be spending this semester working for Dow in Midland, Mich., and GE in Albany, N.Y. She said her summer working in Berlin, W. Germany, was absolutely amazing.

Rovena Sobarzo is at graduate school at Johns Hopkins University in Baltimore. She's working under Mark Salzman (Ph.D., '87) and is having a good time. . . . **Joost Quaadgras** has been extremely busy at Cornell University and expects to finish his master's in June. . . . **Neal Hoyer** is at Washington University in St. Louis. He's "tooling away," working on cell mechanics in the Mechanical Engineering Department. He's still playing trumpet in the pep band for W.U. . . . **Charles Gilman** is working as a civilian for the air force at Wright Paterson AFB in Dayton, Ohio. . . . A special congratulations goes out to Charles and **Wendy Cone** who have recently become engaged. Another special congratulations to Cheryl—she has recently become engaged to Michael Elkins, '88.

I got a letter from **Chuck Davis.** He's in the Army Engineer School at Ft. Belvoir, Va., along with **Andrew Sterbenz, "Rocky" Moy, Paul Sidhu,** and **Mike Mountz.** Andy, Rocky, and Chuck graduate February 26, and Paul and Mike graduate six weeks later. Paul and Andy will be going to Korea; Rocky and Chuck will be going to Germany; and Mike is going back to Motorola (with his new wife) to be in the reserves.

Stacy Weinstein wrote with lots of good information. It sounds like she's having a super time working at the Jet Propulsion Lab in Los Angeles and enjoying that southern California weather. . . . **Lalita Jategaonkar** finished eight months at AT&T Bell Labs (Course VI-A) and is back at M.I.T. for her master's degree. . . . **Charles "Ming" Lee** is working as an investment banker for Smith Barney in Manhattan. . . . **Hong "Mighty Mo" Yang** works for Oracle in Los Angeles. (Stacy said that his office Christmas Party in Marina del Rey was great.) . . . **Vicky Kim** works for Hughes Aircraft. . . . **Charles Coleman** works for the JPL and lives with **Herek Clack** (Rockwell) in north Hollywood. . . . **Nephi Gunderson** and **Rob Godown** are also working for Rockwell. . . . **Gary Zentner** is rumored to live in Westwood and work in Pasadena. . . . **Mike Levin** works for Odentics in the Garden Grove/Anaheim area. . . . **Tom Nichols** works for Avionics Co. and lives in Santa Monica. . . . **Edie Erlandson** and **Andrea Ghez** are grad students at Caltech (boo!).

Ramin Tabizadeh just finished his M.S. in aeroastro. He'll be going to Argentina for a vacation to visit **Martin Hunter.** . . . **Kevin Bartus** finished his E.I.P. stint at Hughes and is now back at M.I.T. for his master's. . . . **Joe DeRosa** is working for an engineering firm in Reading, Pa. . . . **Pochen Hsu** finished his second B.S. (in electrical engineering) at M.I.T. . . . One more Course XVI person, **Jim Bernabeo,** is working for McDonnell-Douglas in St. Louis. Another Congratulations! Jim is engaged to be married in March.

Ross B. Ortega is living in Brighton and working as a software engineer at LTX Corp. in Westwood, Mass. . . . **Hermann Ferre** is still at M.I.T. He wrote that he's enjoying the M.Arch. program.

I saw **Jonathan Suber** at the Thirsty Ear with some other rugby players. He told me that he's working for Industrial Materials Technology in Andover, Mass., and enjoying himself.—**Stephanie Levin,** Secretary, 3201 Eighth St., Charlestown, MA 02129, (617) 242-1618

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Lily S. Ablondi
Glenn H. Ackerman
Eve D. Ahlers
Thomas G. Allen
Lori B. Alperin
Joseph A. Amram
Richard Auchus
Susan E. Babcock
Govind Balakrishnan
Stephen F. Bart
Anne M. Beitz
Laurie A. Benaloh
Warren K. Berger
Peter F. Bernhardt
Andrew J. Bernoff
Gabriel F. Berriz
Catharina R. Biber
Patrick C. Bigot
John D. Blascovich
Lloyd M. Bloom
Brett A. Boal
David W. Borhani
Stephen G. Bradley
Christopher G. Braun
Catherine A. Briasco
Steven N. Brunner
Thomas J. Calderwood
Martin E. Carrera Patino
Tatiana Carvajal Padilla
Glenn D. Cassidy
Sandra B. Champion
Yee-Ning Chan
Charlene Y. Chang
Reginald Chen
Douglas M. Chin
Gladys M. Chin
Jeffrey C. Cohen
David S. Cyphers
Christian C. Daehnick
Wyatt S. Daentl
Mary E. David
Amy R. Davidson
Scott D. Davis
Mark W. Deuser
Patrick W. Dirks
Ellen L. Drascher
Michael G. Feinstein
Brian G. Feldman
Douglas C. Finch
Alfred L. Fordiani III
Karen Fortoul
Keith F. Frame
Charles Frankel
Helen M. Fray
Jeffrey A. Fried
Paul G. Gaddis
Stephen J. Gander
Michael P. Garrity
Michael J. Gatto
Joel R. Gendler
George N. Giacoppe, Jr.
Cindy Gilbert Ehrlich
Melissa L. Goodson
Marshall Gordon
Nancy B. Greenbaum
Dudley B. Hall
Robert E. Handsaker
David P. Harrahy
Nancy M. Hartle
Craig V. Hawkins
Gary J. Henderson
Edmond K. Ho
Alan E. Hodgkinson
Alice Hoffman
John E. Hofmann
Richard S. Hough
Katherine H. Hsu
Nancy M. Huelsmann
Patricia A. Huly
Mark E. Huntzinger
Ralph J. Inglese
Ellsworth D. Johnson
Neil W. Jordan
Janet L. Jozwiak
Matthew D. Kallis
Robert P. Karp
Tamara K. Karsten
Kosuke Kato
Lloyd A. Katz
Philip R. Kauffman
Gontran J. Kenwood
Jung S. Kim
Young-Jae Kim
Christopher G. King
Jonathan E. Koch
Dean Koutsoubis
Joseph A. Kristl
John R. Krooss
David T. Kuller
Alison B. Kutchins
Kevin R. Landman
Thomas A. Lawton
Edmund Lee
Suk Lee
Eric J. Leiser
James E. Lewis
Martin S. Liss
David W. Lui
Johan H. Magnusson
Kamal M. Malek
Premdev S. Malik
Rafe R. Mazzeo
John J. McCauley
Melanie E. Meyers
Joseph A. Minahan
Michelle H. Moas
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Joanna L. Myers
Christina Nebelung
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Mark S. Olivier
George J. Paoletti
Scott G. Paull
David M. Peereboom
Alan W. Peevers
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Robert D. Powell
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Andrew D. Rallis
Alan T. Rath
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Jeffrey A. Reuter
Monica M. Reynolds
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Philip B. Romanik
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Paul A. Roush
Lynn Garry Salmon
Margaret H. Sano
Crystal B. Schaaf
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Galen W. Seitz
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Michael H. Shimazu
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Ivan O. Tou
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Daniel Tsai
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William A. Weeks
James A. Wensley
Ratna W. Widjaja
Alan L. Wimmergren
Stephanie Wingfield
Ben P. Wise
Michael H. Wollowitz
Karl D. Wright
Mary A. Wright
Stephen S. Yao
Muh-Ching Yee
Chi-Won Yoon
Lien Zayhowski

1983
Ridvan Akkurt
Akwete Akoto
Monica S. Alcabin
Albert M. Amzallag
Lisa M. Anderson
Chester T. Barry
William C. Benack



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David W. Charpie
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Don A. Clayton
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Gail A. Cozart Austin
John E. De Rubeis
Marcello Dimare
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John R. English
Anita M. Flynn
Thomas P. Foley
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Kristin K. Foss
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Brian A. Hill
Minh N. Hoang
George Hoehn
Marvin Hom
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Sudhanshu K. Jain
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Lawrence J. Kaufman
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Linus J. Kelly
David S. Keselica
Sun Y. Kim
James F. Kirk
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Steven A. Kosowsky
Ellen D. Kranzer
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Richard G. Larkin
David A. Lefebvre
Steven M. Leibiger
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Harry J. Lipschitz
Eric J. Lipson
F. Yan Liu
Stephen J. Lubiak
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Susan S. Wang
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Lawrence W. White
Damion E. Wicker
Pace G. Willisson
Robert W. Wilson
John F. Woods
Thomas R. Woods
Janet Yanowitz
Katherine L. Zedrose
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1984

Salvador A. Acosta
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Fred D. Allen, Jr.
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Lawrence A. Bair
Gary R. Barnes
Dean E. Barrera
Michael D. Battat
Todd J. Bayer
Carol A. Beck
David P. Berkowitz
Jeffry K. Berner
James W. Bishop, Jr.
Duane S. Boning
Mark P. Bouchard
Russell L. Brand
Jacqueline N. Brenner
Nathaniel E. Brooks
Dennis E. Brown
Heidi M. Brun
Marcos E. Caro
Soma Chaudhuri
Arunas A. Chesonis
Steven M. Chew
Carolyn G. Chin
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Lisa M. Cranton
John H. Cross
Robert B. Diaz
Brett B. Doehr
Joseph D. Drake
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Cameron D. Dryden
John K. Einhorn
Lisa R. English
Rachelle S. Ensio
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Mark J. Farley
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Suzanne Greene
Wayne M. Greene
Lincoln J. Greenhill
Alexander Gruzen
Elizabeth E. Hall
Elizabeth A. Hanson
Kathleen A. Harragan
Ralf Harteneck
Tomohiro Hasegawa
James A. Herndon
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John W. Holcomb
Alexander Holland
Richard W. Holm
Joonkee Hong
Robert S. Horwitz
Michael T. Howard
Bobbie H. Hsi
Todd E. Huffman
Annette E. Hulse
Hewon Hwang
Wesley J. Ishida
Gordon S. Jackson
Denise M. James
Louise Jandura
Jeffrey M. Johnston
David K. Karlin
Pamela L. Kee
Andrew D. Kellen
Preston B. Kemp
Karen M. Kensek
Hyojong Kim
Andrew A. Kimura
Edward W. Kneller
Mark A. Kolb
Douglas H. Kuller
Christopher M. Kurker
Miriam R. Lachman
John G. Lambrou
Edward M. Laufer
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Elaine Lee
Kyu-Ho Lee
William T. Lee
Peter W. Lemessurier
Akim F. Lennhoff
Carolina L. Leonard
Ira H. Leventhal
Andrew B. Levy
Pean Lim
David C. Lingelbach
John R. Linton
Andrew H. Litman
Eric S. Loiederman
Dan C. Lyman
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William T. Maimone
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Timothy P. McElrath
Thomas A. Merrill
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Edwin S. Monuki
Richard F. Mozzicato
Mark F. Needels
Hau Yee Ng-Lo
Anthony M. Nicoli
Georgios Nikolaou
Richard A. Nordstrom
Adrian P. K. Nye
Shawn R. O'Donnell
Edwin M. Oh
Charles H. Oppenheimer
Masatoshi A. Ozeki
Darryl E. Palmer
Christina K. Panagakos
Guy F. Paolini
Janet A. Pesaturo
Ens Heide Piper
Mark L. Polak
Thomas C. Ransohoff
Ronald P. Reade
Richard D. Reohr, Jr.
Anthony J. Riccobono
John A. Rice
Eve A. Riskin
Mark A. Robien
Renee J. Robins
Mitchell A. Rosenberg
Jeffrey H. Rothman
Yoon J. Row
Ronald C. Rubenstein
Dennis J. Sacha
Daniel J. Salaices
David H. Sarr
Jeffrey L. Schenck
Thomas J. Schey, Jr.
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David B. Serafini
Rodney B. Sherman
Gregory B. Shinn
Gregory D. Skinner
Mark A. Skinner
Frank G. Slaughter III
Elizabeth A. Snyder
Kevin L. Soch
Jeffrey L. Southworth
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Robert J. Spinner
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Peter J. Sterpe
Benjamin W. Strowbridge
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Terry B. Tatad
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John R. Winkelman
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Llewelyn C. Wixom
Layne K. Yamada
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Lock S. Yu
Vadim Zlotnikov
Robert P. Zuffante

1985

Diana O. ben-Aaron
Belinda J. Adcock
Gary C. Agranat
Dwight H. Arnold
Kathryn G. Balles
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David M. Beals
Mark N. Beder
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Ira W. Berk
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David E. Buffo
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Carlton J. Chin
May Y. Chin
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Pedro M. Cordeiro Mateo
Marie A. Cunningham
Karen B. Deutsch
Mary S. Di Joseph
Eve D. Durra
Kerry L. Elkins
Louise L. A. Ettedgui Miller
Susan L. Felshin
Daniel F. Flores, Jr.
Alan M. Foonberg
Gregory C. Fu
David L. Fung
Andrew P. Furman
Paul G. Gabuzda
Lisa M. Goldfarb
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Michael L. Harris
Peter K. Hickman
Michael M. How
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Richmond H. Kauffman
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William T. Larkins
Chih Lee
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Shigeki Misawa
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Oliver D. Patterson
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Hugh E. Secker-Walker
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Peng Chong Sien
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Elisabeth Smela
Christina Stanley
Mark C. Staples
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Maureen A. Sybertz
John Tantillo
James T. Taylor II
Abel S. Tong
Walter L. Tucker
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David Volfson
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Aaron Wang
James M. Wang
Ondria J. Wasem
Todd J. Weber
Andrew N. Weiss
Richard M. Willis, Jr.
Barnes W. Woodhall
Gordon M. Wright
Jack Y. Yeh
Domenic A. Zambuto, Jr.
Christopher Z. Zannetos
Guido Zuccarello

1986

Linda S. van Duyne
Stephen G. Andes
Dale S. Archer
Edmund J. Ashburner
Hae J. Baek
Michael D. Bates
Micheal S. Berger
Adam D. Bernard
Robert L. Bieri
Gary H. Blackwood
Hannah E. Bond
Laura A. Bonney
Ronald M. Brisco
James C. Butler
Brian Y. Byun
Nike T. Cacoullos
John C. Cheng
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Cary T. Ching
Eric L. Clayberg
Nancy S. Cook
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Michael A. Davis, Jr.
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Beatriz Garcia
Friedrich G. Geck
Karin D. Getschow
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Joon Hahn
Jon K. Hirschtick
Ka Fai Ho
Michael J. Ho
William M. Hobbib
Henry J. Hoeh
Gordon C. Holterman, Jr.
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Kim L. Hunter
James M. Hutchinson
Thanhtu Huynh
Alka Jain
Michael A. Jones
Robert D. Jones
Steven A. Jones
Rose M. Joseph
Yona Kaplan
Philip T. Keenan
Jisu Kim
Desmond A. Kirkpatrick
James R. Klaiber
David H. Koch
Daniel T. Kulp
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Joseph K. Lo
Robert E. Malecki
Stuart A. Malone
Sean P. Manns
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Yvonne Y. Mao
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John F. Martin
Toshiki Masaki
Mary M. Matthiosen
John P. Mattia
Christopher L. Medina
Paul A. Moschetti
Thomas W. Mullen
C. Daniel Mullins
Hope Tucker Nelson
Lee A. Newberg
John L. Newton
Siu F. Ng
Karen L. Otto
Roland G. Ouellette
Philip A. Paolella
Glen R. Parker
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Craig N. Poole
Simone J. Pottenger
Robert S. Renz
Michael E. Ressler
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Ramy S. Rizk
Grace M. Saccardo
Marian E. Sackler
Sonya S. Sakai
Daniel R. Schmauch
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Edward G. Schmit
Raymond A. Schnitzler
John F. Schuette
Gregory K. Scott
Marta G. Seda-Poulin
Lauren F. Seeley
Earl S. Seifert
Neil E. Shafer
John H. Sheffield
Howard H. Shiel
Jonathan M. Simon
David L. Simson
Lauren E. Singer
Milan Singh
Megan J. Smith
Jennifer F. Solomon
James T. Someren
Ralph J. Spicer
Martin J. St George
Kah K. Sung
John A. Swartz, Jr.
Neville D. E. Teagarden
Diana S. Tener
Ban Leng J. Toh
Lulu S. Tsao
Peter A. Ulrich
Susan A. Visser
William L. Walter
Mei-Hui Wang
Lisa B. Weil
D'Juanna White
Robin M. Whitworth
Mark A. Wolf
Henry Woo
Steven A. Yon
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Ann I. Zabludoff
David J. Zagorski
Noel Zamot

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COURSE NEWS

I CIVIL ENGINEERING

Robert V. Whitman, Sc.D.'51, professor of civil engineering at M.I.T., was keynoter for a conference on earthquake hazards in the eastern United States early in February; his topic: "Engineering Issues of Earthquake Hazards Mitigation." A specialized paper on "Local Models of Seismicity" was presented by M.I.T. Professor **Daniele Veneziano,** Ph.D.'74.

Joel P. Brainard, S.M.'67, writes from Latham, N.Y., "Third child arrived last February . . . still practicing regulatory economics at the New York State Public Service Commission." . . . **Anne E. Carey,** S.M.'86, is an associate at Gradient Corp., Cambridge. The firm specializes in environmental chemistry consulting and interpretation of chemical data. . . . **Thomas S. Maddock,** S.M.'51, is president and chief executive officer of Boyle Engineering Corp., with headquarters in Newport Beach, Calif. Boyle ranks in *Engineering News Record*'s top 100 engineering firms in the United States. Maddock is a licensed engineer in 18 states and was a past recipient of the Society of American Military Engineers Moreell Medal and the Los Angeles Institute for Advancement of Engineering Outstanding Engineer Merit Award for his work in water resources. Maddock is also the 1987-88 chairman of the California State Council of the American Society of Civil Engineers.

Asaf Ali Qazilbash, S.M.'65, reports, "entered fourth year of operating Asaf A. Qazilbash & Associates, consulting civil and geotechnical engineers. I have also been busy serving on the Soils Advisory Committee of the Massachusetts State Building Code. Have also been active in helping the Islamic Center of New England. Two of my four children are now in college. I visited Pakistan in September 1986." . . . **Robert F. Lathlaen,** S.M.'46, who is president, W.J. Barney Corp., building contractors and construction managers in New York City, reports his latest associations: Board of Trustees member, St. Vincent's Hospital, New York City; adjunct professor at New York University, Board of Directors member, Association of General Contractors of America; and Executive Committee member, American Arbitration Association. . . . **Ru-Liang (Leon) Wang,** Sc.D.'65, writes that he is the chairman of the Civil Engineering Department at Old Dominion University, Norfolk, Va. His wife, Chieh-Chun (Joyce) Tien Wang, '61, is an information systems consultant for Metro Information Services, Inc., Virginia Beach. Their children Frank, Mark, and Cindy are currently M.I.T. students. . . . **John P. Wolf,** S.M.'65, writes from Kusnackt, Switzerland, "Prentice-Hall has just published my second book, *Soil-Structure-Interaction Analysis in Time Domain* (1988), which allows nonlinear calculations to be performed (in contrast to the first book, *Dynamic Soil-Structure Interaction,* which concentrates on the frequency domain).

Norman R. Rosen, '54, retired (June 1987) as president of A. Epstein and Sons, Inc., Chicago, and is now in private consulting. . . . **Stephen Gordon,** S.M.'82, writes, "I was recently hired as director of transportation of Hartz Mountain Industries, a New Jersey real estate development corporation. My job is to design transportation services and infrastructural improvements for new mixed-use developments along the New Jersey Hudson River waterfront. These services include buses, a light rail system, and ferries to Manhattan, and I'm having a ball!" . . . **Manas K. Chakravorty,** Sc.D.'72, is currently a senior consulting engineer with Houston Lighting and Power Company and administrator of the Nuclear Safety Review Board for the South Texas nuclear plant. . . . **Roberto L. Lenton,** Ph.D.'74, has been appointed director general of the International Irrigation Management Institute (IIMI), an international organization based in Sri Lanki with operations in several countries of Asia and Africa. . . . From **Robert F. Seedlock,** S.M.'40, of Falls Church, Va., this list of four current assignments: editor of the *Journal of Aerospace Engineering;* U.S. representative to the Permanent International Association of Navigation Congresses; director of T.Y. Lin International; and chief liaison and consultant to the Chinese Academy of Sciences/Beijing Institute of Management.

Walter M. Gray, Ph.D.'71, who taught physics at M.I.T. in the 1930s and later became purchasing agent for the University Hospital of Boston, passed away on December 30, 1987. Gray was a resident of Fitzwilliam, N.H.; he died at the winter home of his daughter in Jensen Beach, Fla. As a resident of Lexington, Mass., Gray had been a member of the Men's Club of Hancock Congressional Church, and he was active in the Richard C. MacLaurin Lodge of Masons at M.I.T. . . . **Audun Ofjord,** S.M.'50, of Bergen, Norway, passed away on July 3, 1987; no further details are available.

II MECHANICAL ENGINEERING

Leonard E. Smollen, '62, executive vice-president and general manager of Venture Founders Corp., Lexington, Mass., has resigned as director of Disc Technology Corp. . . . **Charles K. Leeper,** S.M.'48, is principal in Kenlee Technologies, which specializes in planning for corporate R&D, safety and quality programs. . . . **Kenneth Kan,** S.M.'80, joined the Storage Technology Department, Digital Equipment Corp., Shrewsbury, Mass., as a principal mechanical engineer in December 1987. His responsibilities include life testing and failure analysis of disk drives and tape drives.

From Versailles, France, come greetings from **Mario M. Rathle,** S.M.'59, who writes, "I have been living overlooking the chateau for almost two years. I am the deputy program manager in France for a multi-billion-dollar defense contract which GTE has with a French company—a challenging and exciting assignment that will last many years. The office is in a southwest suburb of Paris only 20 minutes from my home." . . . **Dwight E. Beach, Jr.,** S.M.'65, writes from Houston that he gave a presentation to the Houston chapter of the M.I.T. Enterprise Forum on business plan of Houston Engineers, Inc., of which he is president. He describes the Forum as "a good organization and a service to the community." . . . **Daniel Hunt,** S.M.'48, reports that he moved to Annapolis, Md.

Admiral **Hugo F. Schieck, Jr.,** S.M.'60, of Rio de Janeiro, Brazil, passed away in 1987. Schieck's wife, Julia, writes, "To our satisfaction he succeeded in life in all fields: as a man, as a naval officer, and as an engineer. He was nationally and internationally recognized for his tenacity in trying to always do his best. . . . He never forgot that he was an M.I.T. man."

David R. Lampe, S.M.'76, assistant director of M.I.T.'s Industrial Liaison Office, is editor of *The Massachusetts Miracle: High Technology and Economic Revitalization* (M.I.T. Press, 1988, $16.95). It's a collection of statements, policies, and opinions bearing on the rapid development of high-technology industry in Massachusetts since the 1950s. Among the contributors: **Bennett Harrison,** M.I.T. professor of political economy and planning; **Lynn E. Browne,** Ph.D.'80 (XIV), vice-president of the Federal Reserve Bank of Boston; and **David L. Birch,** senior research scientist in the M.I.T. Laboratory of Architecture and Planning.

III MATERIALS SCIENCE AND ENGINEERING

Last November **Joan Adams,** S.M.'80, of Washington, D.C., started a new company, Atlantic Fuel & Power Corp. The firm produces on-site power generators and cogenerators to help industries reduce their utility bills without reducing production. . . . **Charles P. Ashdown,** Ph.D.'84, Arlington, Mass., is technical director of Ultrafine Powder Technology, Ayer, Mass., recently incorporated to produce sub-20mm metal power. . . . **George Krauss,** Sc.D.'61, is currently director of the Advanced Steel Processing and Products Research Center at the Colorado School of Mines, Golden. This center is an NSF-initiated cooperative research center currently supported by 10 corporations and government laboratories.

David B. Knorr, Sc.D.'81, of Clifton Park, N.Y., has been appointed (June 1987) assistant professor in the Materials Engineering Department at Rensselaer Polytechnic Institute. . . . **John H. Walsh,** Sc.D.'55, of Ottawa, Canada, reports that he is the author of a book, *Understanding Technology and Canadian Public Policy,* published last August. . . . **Anders F. Henriksen,** Sc.D.'78, writes of Ceramco, Inc., the company he founded in 1982: "The company specializes in the manufacture of ceramic components using a low-pressure injection technique. It currently employs seven people and is expanding from its present facility in Center Conway, N.H., into a newly built 6,000-square-foot factory in Fryeburg, Maine. Ceramco, Inc., has among its customer base Du Pont, Honeywell, Raytheon, and Perkin-Elmer."

New Directions for International Studies

By Catherine Girrier

A broader emphasis for the Center for International Studies (CIS) that will reflect the full range of international research and teaching at M.I.T. is the goal of Professor Myron Weiner as he settles in as the new CIS director.

Last summer, Weiner succeeded Professor Eugene B. Skolnikoff,'49, director for the past 15 years.

Under Skolnikoff's leadership, CIS focused chiefly—and very successfully—on the effects of scientific and technical matters on international affairs.

While Professor Weiner is proud of the legacy he has inherited and hopes to continue the ongoing programs, he is eager to broaden the Center's activities beyond problems related to science and technology. "People are really not fully aware of the range of international research and teaching that go on at M.I.T.," Weiner says, and he would like to see CIS reflect that range of activities.

One of the first targets for expansion is the "Seminar XXI" program on Foreign Politics and the National Interest. This two-year-old seminar series is conducted in Washington to bring CIS' expertise in foreign political systems to people in government agencies. The concept first took shape in a conversation between an officer of IBM (M.I.T. graduate student Mitzi Wertheim) and Professor Suzanne Berger of the Political Science Department. Berger was describing a course in which she introduces graduate students to different conceptual models of foreign political systems. Wertheim was fascinated and suggested that the analysis would be important for people in the U.S. government, especially in the Defense Department.

The result was a series of nine monthly meetings in Washington in 1986-87, in which experts from the United States, Canada, Japan, France and West Germany shared their political knowledge with an audience of flag- and general-rank military officers from each of the four services; military officers currently assigned to the Office of the Secretary of Defense, the State Department, and the National Security Council; and civilians from the Department of Commerce, the Treasury Department, the intelligence community, and the private sector. Based on the success of this effort and a generous grant from Harry Kalker, '23, its organizers are now in the process of expanding this program to include a larger number of people from the Department of State.



Professor Myron Weiner and his Afghan hound, Kushan.

CIS is sponsoring a number of faculty/graduate-student workshops to strengthen its role as a "flagship" for international studies at M.I.T. Three examples:

☐ A workshop started last fall by Professor Judith Tendler of the Department of Urban Studies and Planning on rethinking the role of the state in third-world development. Students are working on such topics as the Korean model of development, the problems of state-owned enterprises, farmer-state relations in Africa, regional development programs in Brazil, and state-run poverty programs in India.

☐ The future of international migration, a spring workshop organized by Weiner and Professors Jerome Rothenberg (economics) and Nazli Choucri (political science) with financial support from the Sloan Foundation.

☐ Another spring workshop—problems confronting advanced industrial economies—organized by Professors Suzanne Berger and Charles Sabel of the Political Science Department and Michael Piore of the Economics Department.

In addition, Weiner wants the Center to do more than it has in the past to encourage interest in international affairs among M.I.T. undergraduates, who typically come here to work in science and technology. "I think our engineers . . . need to understand the politics and international relations of other countries because decisions in these realms also affect scientific and engineering decisions." One way to do this, says Weiner, would be a summer fellowship program for undergraduates in Washington or in foreign capitals.

Another role for CIS, says Weiner: as a catalyst, helping faculty members from throughout the Institute discover common interests and then to develop and fund programs.

One such field of common interest is Soviet studies. Professor Stephen Meyer (political science) has been running a robust teaching and research program on Soviet security studies. Meanwhile, Professor Loren Graham (Program in Science, Technology and Society) has been working with students in the history, development, and contemporary role of science and technology in the Soviet Union. Now Weiner would like to broaden these activities. For example, he envisions research on the "domestic and international components of Soviet science and technology and how they interact with the economic, political and societal structure of the Soviet Union to shape Soviet foreign policy."

But the most comprehensive theme in Weiner's agenda is what he calls the " 'intermestic field' . . . the ways in which international affairs link with domestic developments. . . . I don't see how you can study a major international problem without understanding both its internal and international components." In the same way, he continues, "one cannot understand how economic and political systems develop domestically without understanding the international effects upon them." ☐

CATHERINE GIRRIER is a Ph.D. candidate in the Political Science Department.

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Neil Elliott Rogen, M.T.E.'57, is chairman of Memory Metals, Inc., Stamford, Conn., a firm specializing in the development of shape-memory-effect (SME) metal alloys that take on a new configuration at set temperatures and then return to their previous configuration when the original temperature is restored. Rogen formerly served as president of Elektra Energy and Hemisphere Licensing Corp., two privately-held companies, in the early 1980s.

IV ARCHITECTURE

For the third year, Robert B. Newman Student Medals have been awarded to recognize merit in architectural acoustics. The medals, which were established in memory of **Robert Newman,** M.Arch.'49, a member of the M.I.T. architecture faculty for more than 30 years, went this year to students at the Boston Architectural Center, Clemson, Harvard, and the University of Florida.

Radoslav Zuk, M.Arch.'60, reports from Montreal that he has been elected a fellow of the Royal Architectural Institute of Canada. . . . **Nicholas P. Negroponte,** M.Arch.'66, director of M.I.T.'s Media Laboratory and professor of media technology, has been named a director of Rise Technology, Inc., Cambridge. . . . **Alan Dolmatch,** M.Arch.'68, has been a principal for the past two years in the firm of Aldrich, Eastman, and Waltch, Boston, real estate counsel to tax-exempt pension and endowment funds. Domatch lives in Newton with his wife Nancy Ferguson.

Steve Imrich, M.Arch.'80, project architect with Cambridge Seven Associates, has been selected to serve a two-year term on the Cambridge Housing Authority's Local Screening Committee for the State Designer Selection Committee. . . . **David J. Mullman,** M.Arch.'77, reports, "I had an eventful couple of years. Last year I got married. This year I opened my own architectural practice." . . . **John K. Felix,** M.Arch.'86, is employed as job captain of Arrow Street Architects, Cambridge. . . . **Michio Ihara,** '62, writes from Concord, Mass., that he is an architectural sculptor. His recent installations: Lowell National Park at Hilton Inn, and the fountain sculpture "Pawtucket Prism."

Rory Christopher Mathis, S.M.'82, reports from Annapolis, Md., that he is a research scientist at the NAHB National Research Center. "Just initiated the first national performance testing and certification program for fenestration products. Currently program manager for thermal insulation product certification. . . . **J. Robert Taylor,** M.Arch.'65, writes from Muncie, Ind., that he is president of Taylor Architects, Inc., professor of architecture at Ball State University, and president of Central Southern Indiana A.I.A. (1987-88). . . . **Ewart A. Wetherill,** M.Arch.'58, writes from Alameda, Calif., of his 1987 activities: principal of Wilson, Ihrig & Associates, acoustical consultants, Oakland; chairman of the Technical Committee on Architectural Acoustics, Acoustical Society of America; fellow of the Acoustical Society of America; member of AIA and RAIC; registered architect in South Carolina and British Columbia; author of invited papers at Inter-Noise 87 conference in Beijing and fall meeting of the Acoustical Society of America; and lecturer at the School of Architecture at Tongji University, Shanghai, University of California, and Stanford. Among all these awards and activities, Wetherill also notes that he is a member of the Robert B. Newman Memorial Student Award Committee.

Robert L. Ziegelman, M.Arch.'59, reports another long list of 1987 activities from Birmingham, Mich.: "Received two awards from the Masonry Institute of America; lectured at the Michigan Society of Architects One Hundredth Anniversary Convention on my firm's architectural impact; and am presently designing a $70 million multi-use office-hotel-commercial complex, a $25 million Michigan National Bank world headquarters, and a house in Aspen, Colo.

Gardner Cox, '32, the well-known portrait painter, passed away in Cambridge last January. Cox painted from life—government leaders, educators, poets, scholars, doctors, lawyers, and businessmen—including a controversial portrait of Henry Kissinger that its subject refused to have hung in the State Department. "Cox had a distinctive, contemporary style of painting, with expressionist overtones. He used free and fluent brushwork, subtle and warm colors to give his canvasses a feeling of spontaneity," said the Associated Press obituary.

V CHEMISTRY

Robert W. Field, professor of chemistry at M.I.T., received the $5,000 1988 Earle K. Plyler Prize of the American Physical Society in New Orleans in March. He was cited for "seminal contributions to molecular spectroscopy."

John M. Deutch, '61, who is provost and Compton Professor of Chemistry at M.I.T., is a member of the Board of Directors of the Council on Superconductivity for American Productiveness, a Washington-based clearinghouse and advocate for high-temperature superconductivity research and technology.

Joel Silver, Ph.D.'76, is a co-founder and vice-president of Southwest Sciences, Inc., Santa Fe. . . . **Gary S. Calabrese,** Ph.D.'83, writes that from 1983-85 he served as a scientist at Polaroid Corp. and is currently a principal scientist at Instrumentation Laboratory, Lexington, Mass. . . . **Steven J. Gould,** Ph.D.'70, received a 1987 Faculty Research Excellence Award from the American Cyanamid Company. Gould is on the chemistry faculty at Oregon State University, Corvallis. . . . **J. Thorck Watson,** Ph.D.'65, continues as professor of biochemistry and chemistry at Michigan State University and as director of MSU's Mass Spectrometry Facility. Watson is completing a six-month sabbatical leave at the Ecole Normale Superieure, Paris.

David A. Roise, Ph.D.'84, has been appointed assistant professor in the Department of Chemistry at the University of California, San Diego. . . . **Ned M. Weinshenker,** Ph.D.'69, writes from Palo Alto, Calif., that he is a consultant for MBW Management, Inc., a venture capital fund; and is president of Cyclex, Inc., a start-up drug delivery company. . . . **Harold R. Nace,** Ph.D.'48, writes from Barrington, R.I., that he retired from the Brown University faculty in 1986, having gone to Brown upon completion of his doctorate. He was the first graduate student of the late Professor **Arthur C. Cope,** arriving at M.I.T. on March 1, 1945. . . . **Lionel S. Galstaun,** Ph.D.'36, of Danbury, Conn., retired from Bechtel Petroleum, Inc., on December 31, 1983, and is presently a consulting engineer on a part-time basis for projects involving coal gasification and down-stream conversion to fertilizers and other chemicals.

Joseph Ciabattoni, Ph.D.'65, reports that he is in private practice in internal medicine and is living in North Providence, R.I. Ciabattoni served as a resident at Rhode Island Hospital from 1986 to 1979, having studied at Yale for his M.D. (1976). . . . **John T. Viola,** Ph.D.'67, writes from Thousand Oaks, Calif., "My work as a program manager at Rockwell International Science Center continues to be both challenging and rewarding. We are making progress in developing infrared detectors for both military and civilian applications in preparing for microgravity experiments when shuttle flights resume this year." . . . **Doron Dagani,** Ph.D.'75, writes from Silver Spring, Md., "I have been promoted to senior editor at *Chemical and Engineering News,* the weekly newsmagazine of the American Chemical Society, where I've been for more than eight years." . . . **Michael A. Kay,** Sc.D.'70, writes, "I have left the academic world and assumed the position of manager of chemistry research and development for Hanna Car Wash International, Milwaukie, Ore. Hanna is the world's largest manufacturer of

vehicle wash equipment, doing business in 66 countries." . . . **Maung M. Sein,** S.M.'61, writes from Singapore, "I am working as vice-president of Alfa-Laval South East Asia Ltd., which is the regional headquarters of Alfa-Laval AB of Sweden, whose chief executive officer is **Harry Faulkner** (Course IX, '54). My son Zarli might come to M.I.T. in two years."

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

W. Daniel Hillis, '78, of Thinking Machines, Inc., Cambridge, is the author of "Why Parallel Processing Is Inevitable" in a collection of essays on *Supercomputers: A Key to U.S. Scientific, Technological, and Industrial Preeminence* (Praeger, 1987, $39.95). There are "fundamentally correct" reasons, he writes, for going to parallel processing, which will "have performance that is hundreds of times more than is possible with vector processors."

Formerly head of MITRE Corp.'s Communications Engineering Department, **Thomas H. Nyman,** S.M.'66, has been promoted to associate technical director of Battlefield Systems at MITRE's McLean, Va., division.

The state of IEEE's Control System Society, of which he was president in 1987, was the subject of **Alexander H. Levis,** Sc.D.'68, at a session of IEEE's Boston Section early this year. Since 1979 Levis has been a senior research scientist at the M.I.T. Laboratory for Information and Decision Systems.

Wolf Kohn, Ph.D.'78, writes, "I am conducting research towards the formulation of a computable first order theory of control systems for rational dynamical systems. This includes the specification of a graph reduction computer architecture for the implementation of theorems of feedback controllers. The theory is called declarative controllers for rational systems." . . . **Roy L. Morris,** S.M.'78, has joined the long-distance communications company, Allnet, Washington, D.C., as its deputy general counsel. He is responsible for addressing major technically oriented communications, legal, and policy issues before major government agencies and the courts. . . . **Erik T. Ringkjob,** '60, is currently president and chief executive officer of Digital Storage Systems, Inc., Longmont, Colo.; and chairman of the IBM-Compatible Winchester and Tape Subsystem supplier. Formerly, Ringkjob served as president of Intecom, Inc., Allen, Tex., a subsidiary of Wang Laboratories, Inc.

Edward E. David, Jr., Sc.D.'50, who heads his own consulting group in Bedminster, N.J., has become a director of Intermagnetics General Corp., Guilderland, N.Y. . . . **Garry Meyer,** S.M.'72, is vice-president—computer support services for the Debt Rating Division of Standard & Poor's Corp. Meyer and his wife, Ellen, live in Stamford, Conn., with their three children. . . . **James S. Meditch,** S.M.'57, has been appointed associate dean for academic affairs, College of Engineering, University of Washington, Seattle. . . . From **Peter J. Metz III,** S.M.'67, Newton, Mass.: "I recently joined Digital Equipment Corp. as U.S. area transportation strategy manager after eight years as a transportation management consultant." . . . **Dean Vanderbilt,** Ph.D.'70, of Dallas, is currently vice-president, Financial Services Recognition Equipment, Inc.; he is serving his third two-year term on the Dallas City Council.

Stephen D. Moxley, Jr., S.M.'50, founder and president of Avex Electronics Corp., Inc. (formerly Avco Electronics), and an active member of the Huntsville, Ala. business and civic community, passed away on December 30, 1987. Under the leadership of Moxley, Avex grew from 10 to 1,000 employees and opened plants in Singapore and Scotland. Among many civic and professional affiliations, Moxley was the senior M.I.T. educational counselor for Huntsville, past chairman of the Capstone Engineering Society at the University of Alabama, a deacon of Huntsville's First Presbyterian Church, and chairman of the Madison County Republican Executive Committee.

VI-A Internship Program

The activities for the selection of the 71st VI-A class began with the traditional business meeting, annual dinner, and company open house on February 29. This was the first of these activities to be held under the directorship of **Kevin J. O'Toole.**

During March 1 and 2, the participating companies interviewed this year's 154 sophomore applicants (56 percent of Course VI sophomores, up 3 percent from '87). This is down from last year's 172 applications, but note that this year's Course VI sophomore class is down from 325 last year to 275 this year.

The ending of the affiliation of Fairchild with Schlumberger has brought this year's decision that Fairchild will not select new students for either the South Portland, Maine, or Palo Alto

Picture Telephones Reborn

By John W. Anderson

The picture telephone is back, and its proponents—including a handful of M.I.T. alumni—propose that their product will generate annual sales of $200 million by the end of the decade and spark the next revolution in the white-collar corporate workplace.

The original picture telephone of the 1960s is like the Edsel—one of the classic marketplace mistakes, an invention whose time never came. It was based on analog technology, very expensive to use because of the very large bandwidth required for transmission.

Digitized television signals have changed all that: they can be compressed and otherwise manipulated by computer, so bandwidth problems can be made far less intimidating. As a result, say believers, the door to the business of business videoconferencing is ready to swing open.

The quest for the new technology began in August 1983 when two M.I.T. graduate students, Brian L. Hinman, S.M.'84, and Jeffrey G. Bernstein, S.M.'84, began research on compressing digitized video for high-definition television. They were working under David Staelin, '60, Cecil H. Green Professor of Electrical Engineering.

Their goal was to achieve video resolution approaching that seen on 35-mm. film without increasing the bandwidth beyond that required for conventional television broadcasts. Their strategy was to use all the high-definition techniques that digital processing made possible but send fewer frames per second. They accomplished the goal by devising computer programs that could average the motion in sequential frames, thus reducing the number of frames that had to be broadcast.

This success encouraged Hinman, Bernstein, and Staelin to commercialize the concept in a new video telephone by forming a start-up company they called PicTel (renamed last year as PictureTel). Their computer programs compressed video signals to bandwidths 0.1 percent of those needed for conventional television. Thus in August 1983 PicTel achieved for the first time the basic technology required for a practical video telephone.

Who and Where Are the Customers?

John Tyson, president of Compression Laboratories, San Jose, one of PictureTel's competitors, cites the familiar argument: the picture telephone will revolutionize corporate meetings; instead of traveling in order to see each other, executives can make video conference calls.

Norman Gaut, Ph.D.'67, president of PictureTel, also sees some less conventional markets: use video telephones to sell houses to distant buyers, for example, or let lawyers take depositions from witnesses wherever they are. Potential savings would be "enormous," Gaut says, due to reduced travel and increased productivity.

There remains, however, a problem. Though required bandwidth is much reduced, picture telephones still require special telephone lines. By the end of 1987, AT&T offered the necessary services in 76 major cities, and services will be ready in many more communities by the end of the decade. Regional Bell companies are adding the services apace, and so are other long-distance carriers such as MCI.

Picture quality remains a frustration, too. The video images still suffer from slight blur and occasional stilted movements. Gaut doesn't perceive this as a major problem. "The imperfections bother you a little at first," he admits, "but then you get used to it, like anything else. Humans are very adaptable." And improvements in hardware and coding are expected to reduce the problems.

But the marketplace is slow to register demand, and skeptics abound. Among them is Frank LoPinto of the Independent Scientific Corp. "This kind of thing just doesn't replace personal contact in a meeting," he says. "You can't go out for a drink with the image on a telephone." □

JOHN W. ANDERSON *is a lawyer and freelance writer with headquarters in New York City.*

research facilities. However, Schlumberger-Doll Research of Ridgefield, Conn., will be taking their first students this summer and Schlumberger Palo Alto Research and Sentry/Schlumberger in San Jose, Calif., will be continuing their normal participation in the program.

The David Sarnoff Research Center will continue its long-time participation under its new affiliation with SRI, and will select new students this year. Associate Department Head Professor **Richard B. Adler** Sc.D.'49, will continue as Sarnoff's VI-A faculty advisor.

It was wonderful to have so many of our alumni who were here for the VI-A interviewing stop and chat with me. It was like "old home week." With Lydia's help (and I apologize for any omissions—for which let me know) here is a list of VI-A attendees: **Steven L. Bates,** S.M.'76, GenRad; **Dean R. Collins,** S.M.'59, Texas Instruments; **Chester M. Day, Jr.,** S.M.'58, Bellcore; **Charles B. Dieterich,** '78, Sarnoff Research Center; **Jenny Ford,** '82, Motorola; **Neil M. Haller,** '59, AT&T Bell Laboratories; **Nancy M. Hartle,** S.M.'82, Honeywell/Electro-Optics Division; **Tomohiro Hasegawa,** S.M.'85, Hewlett-Packard/Medical; **Glenn A. Kramer,** '84, Schlumberger/Palo Alto Research; **Gary K. Montress,** S.M.'71, Raytheon Co.; **Anthony M. Nicoli,** S.M.'85, Honeywell/Electro-Optics Division; **John R. Selin,** S.M.'70, Raytheon Co.; **L. Alan Snyder,** '73, Hewlett-Packard Laboratories; and **Marc A. Zissman,** S.M.'86, Lincoln Laboratory.

Already some of our new VI-A's are showing signs of success. Of 18 juniors selected as Burchard Scholars this year, four are VI-A's: **John R. Buck, Steven B. Chanin, Robert "David" Duis,** and **Anuradha Vedantham.** Selections are made by the School of Humanities and Social Science from among students demonstrating unusual abilities and academic excellence in the areas embraced by the school. The award is named after the school's first Dean, **John E. Burchard,** '23.

Visitors to the VI-A office have included: **Richard E. Anderson,** S.M.'87, presently with NCR, Cambridge, Ohio; **David A. Chan,** S.M.'83, with KLA Instruments, Inc., Santa Clara, Calif., who told me his brother, **Gregory Chan,** S.M.'87, is with IBM Laboratories, San Jose, Calif.; **Imre Gaal, Jr.,** '86, continuing his medical studies at Dartmouth; and **Lynn M. Roylance,** '78, interviewing for Hewlett-Packard Laboratories, Palo Alto, Calif.—John A. Tucker, Special Assistant to Department Head for VI-A & Lecturer, M.I.T., Rm. 38-473, Cambridge, MA 02139.

VII BIOLOGY

In recognition of what President **Paul E. Gray,** '54, calls "outstanding contributions to both education and scholarship in cellular and molecular biology," Professor Phillip A. Sharp has been named to the John D. MacArthur Professorship at M.I.T. Sharp has headed the Center for Cancer Research since 1985.

The $15,000 USX Foundation Award in Molecular Biology has come to **H. Robert Horvitz,** '68, professor of biology at M.I.T. Horvitz is cited for "signal contributions to the genetic analysis of the development of cell lineages in the nematode *C.elegans*," according to the National Academy of Sciences, which made the selection. . . . A major new honor for Professor **David Baltimore,** '61, director of M.I.T.'s Whitehead Institute for Biomedical Research: the 1987 Rabbi Shai Shacknai Memorial Prize in Immunology and Cancer Research. It's given annually by the Lautenberg Center of Hebrew University-Hadassah Medical School, Jerusalem. Baltimore was also named early this year a member of a new Institute of Medicine oversight committee to monitor the nation's response to the AIDS epidemic and identify problems and needs.

Michael S. Jacobson, Ph.D.'69, cofounder of the Center for Science in the Public Interest in Washington, is launching what he hopes will be a national movement under the banner of Americans for Safe Food. Materials already available are "full of practical tips about how to get your supermarkets to offer contaminant-free foods," writes consumer advocate Ralph Nader.

Four members of the M.I.T. community figure in recent news from the Worcester Foundation for Experimental Biology: **Harriet L. Robinson,** Ph.D.'65, has been promoted to the rank of principal scientist; **David L. Steffan,** who completed postdoctoral work at M.I.T. in 1980, now holds the rank of senior scientist; and two recent M.I.T. postdocs, **Hagan Bayley** and **Alonzo H. Ross,** have taken posts as senior scientists—Bayley from Columbia University and Ross from the Wistar Institute, Philadelphia.

James G. Gusella, Ph.D.'80, a geneticist at the Harvard University Medical School and on the staff of Massachusetts General Hospital since 1980, was awarded the New York Academy of Sciences' A. Cressy Morrison Award in Natural Sciences. Gusella was honored for discovering the location of the defective genes which cause several inherited disorders of the nervous system.

VIII PHYSICS

Stephen Lukasik, Ph.D.'56, vice-president at Northrup Corp., who is chairman of the Board of Directors of the Software Productivity Consortium, reports a "rapid pace of progress" by the consortium, of which **Jonathan D. Addleston,** '65, is vice-president. The consortium's purpose is to build computer-aided software engineering tools and technologies for its member companies, which now number 14. To accelerate work in "several avenues of software technology" and perhaps to build a software environment simulation laboratory, says Lukasik, the consortium is seeking up to three new corporate members.

To **Matthew J. Mayberry,** Ph.D.'86, the American Physical Society's Simon Ramo Award for Outstanding Doctoral Thesis Research; Mayberry's thesis was on the relationship between current, plasma density, and frequency in tokamaks.

Eighteen alumni are among newly elected members of seven divisions of the American Physical Society:

□ Division of Astrophysics: **Martin O. Harwit,** Ph.D.'60, for "outstanding contributions to theoretical and observational infrared astrophysics"; and **Allen S. Krieger,** Ph.D.'67, for work in solar astrophysics "establishing a firm connection between coronal holes and high-speed solar wind."

□ Division of Atomic, Molecular, and Optical Physics: **Paul D. Burrow,** '60, for work in electron transmission spectroscopy.

□ Division of Condensed Matter Physics: **David S. Cannell,** Ph.D.'70, for "contributions in the study of nonlinear and collective phenomena"; **Charles S. Fadley,** 63, for work in photoelectron microscopy; **Charles M. Falco,** '56, for "unique and leading contributions in the area of metallic superlattices"; **Lionel C. Kimerling,** Ph.D.'69, for "fundamental contributions to . . . understanding the electrical properties of defects in semiconductors"; **Gene F. Mazenko,** Ph.D.'71, for methods for studying "dynamical critical phenomena and growth kinetics problems"; **Cherry Ann Murray,** Ph.D.'78, for studies of "surface-enhanced Raman effect and of two-dimensional melting"; **Jamshed R. Patel,** Sc.D.'54, for work in x-ray characterization of crystalline solids; and **James C. H. Tsang,** Ph.D.'73, for "creative use of Raman spectroscopy."

□ Division of High-Polymer Physics: **Norman Brown,** '42, for work on the structure of crystalline, polymeric, and biological materials.

□ Division of Nuclear Physics: **David J. Ernst,** Ph.D.'70, "for development and understanding of intermediate energy reactions."

□ Division of Particles and Fields: **Louise Ann Dolan,** Ph.D.'76, for work on "field theory at finite temperature" and other particle physics problems; **E. Joseph Eichten,** '72, for quarkonium spectroscopy; and **Roberto D. Peccei,** Ph.D.'69, for "contributions to gauge theories of elementary particles."

□ Division of Plasma Physics: **Gerald Cooperstein,** Ph.D.'68, for work on intense electron and ion beams and for applications of inductive energy storage techniques; and **Nathaniel J. Fisch,** Ph.D.'78, for theoretical work on torroidal confinement devices.

M.I.T.'s Class of 1942 Career Development Professorship has been assigned to **Stephan S. Meyer,** assistant professor of physics, to recognize "his innovative contributions to undergraduate teaching quality and excellence," says **John M. Deutch,** '61, provost. The professorship was given by the class in anticipation of its 50th reunion to encourage imaginative teaching. Meyer came to M.I.T. from Princeton for postdoctoral work in 1979 and has been a member of the faculty since 1984.

To Institute Professor Emeritus **Philip Morrison** of M.I.T., the first annual $2,500 AAAS Award for Public Understanding of Science and Technology. The prize is a project of the American Association for the Advancement of Science, with cosponsorship of the Westinghouse Electric Fund. Morrison was cited especially for his six-part public television series, "The Ring of Truth," first aired late last year. "Scientific knowledge and understanding are not a purely cerebral affair; they are soaked with emotion, excitement, and nervous tension, as everybody knows who has heard Philip Morrison talk," said the AAAS citation.

Jose A. Garcia-Barreto, Ph.D.'82, reports that since 1982 he has been a research associate at the Instituto de Astronomia of the National Autonomous University of Mexico. Garcia-Barreto's research focuses on radio astronomy using U.S. radio telescopes and at optical/infrared wavelengths using the 2.12m optical telescope in San Pedro Martir, Mexico.

XII EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

Three alumni are contributors to the 1987 annual report of Columbia University's Lamont-Doherty Geological Observatory—**W. Roger Buck IV,** Ph.D.'85, **William H. Menke,** '76, and **G. Alan Zindler,** Ph.D.'80. Buck, who is associate research scientist at Lamont-Doherty, reports with colleagues on their work on volcanic passive margin structures; Assistant Professor Menke on geophysical tomography, and Assistant Professor Zindler on studies of trace elements in mantle-derived basalts.

Industrial sponsorship is being sought by Professor **Daniel Rothman** for a new program at M.I.T. to study methods for determining the permeability of rocks. Rothman notes that existing strategies lead to errors of a factor of ten or more and that fundamental understanding of the mechanisms of porous flow is lacking. The problem is important for understanding ground water movement and for estimating the economic potential of oil wells.

Academic offerings under the joint program between M.I.T. and the Woods Hole Oceanographic Institution will be expanded beginning next fall to include a master of science degree. Joint doctorates and engineer degrees have been given since the inception of the program in 1968, but many master's students have studied at both institutions while receiving only M.I.T.'s degree.

Donald G. Friedman, Sc.D.'54, director of the Natural Hazards Research Program at the Travelers Insurance Cos., Hartford, has been elected to membership in the Connecticut Academy of Science and Engineering. . . . **Edward P. Laine,** Ph.D.'77, assistant professor in the Department of Geology at Bowdoin College, Brunswick, Maine, received funding from the National Science Foundation for a three-year study of sedimentation. The research team will use computer-generated models and on-site investigations to study the movement of sediment along

the continental shelf, says Laine. . . . **David Atlas,** Sc.D.'55, reports from Bethesda, Md.: "Now working as a consultant under contract to NASA on a joint U.S./Japan mission to measure rainfall from space. I have been appointed a distinguished visiting scientist at Jet Propulsion Laboratory, Cal Tech, and in 1986 I was elected a member of the National Academy of Engineering."

XIII OCEAN ENGINEERING

To **Leslie A. Harlander,** S.M.'55, president of L. A. Harlander and Associates, the Gibbs Brothers Medal for "outstanding contributions in the field of naval architecture and marine engineering." Harlander is cited by the National Academy of Sciences, which administers the award, for "pioneering effort in the design of specialized vessels and cargo-handling equipment associated with intermodal shipping by container systems."

Paul P. Daulerio, Jr., S.M.'70, of Weston, Conn., has been appointed director of the Corporate Services Department at Texaco, Inc., and will continue to work out of the company's office in Harrison (N.Y.). . . . **Bradley F. Bennett,** S.M.'40, writes from Las Cruces, N. Mex.: "After ten years as vice-president of Universities Research Association (M.I.T. is a charter member), I retired in 1977. I spent one year on the staff of the National Science Board. Since then I have been totally retired, but very interested in the Superconducting Super-Collider (SSC)." . . . **Young Sohn,** S.M.'83, writes: "Young, Marly, and Adam are beginning their fourth year in Seoul, Korea. The Intel office has expanded from its original one-person operation to 32 members. Anybody coming for the 1988 Olympics, please call me at: 02-784-8186."

Robert W. Gulick, S.M.'76, of Pomona, N.Y., has recently been promoted to president of the New York Institute of Finance, Simon & Schuster, Inc., a Gulf + Western company. . . . **Deborah S. (Sides) Pontifex,** S.M.'82, reports, "I was married in August 1987 to attorney Kenneth Pontifex from Prince George, B.C., Canada. Ken has relocated to Santa Barbara, where (as of early 1988) he was preparing for the California Bar Exam. I continue to work for Science Applications International Corp., a consulting firm, primarily on environmental issues associated with offshore oil development." . . . Commander **Robert G. Vorthman, Jr.,** S.M.'77, has re-located to Governors Island, N.Y., and been assigned as head of the Coast Guard Operations Computer Center.

William C. Gibson, N.A.'51, writes a lengthy letter from Annapolis, Md. Here are some highlights: "Libby and I recently hosted official members of a trade delegation from Dumfries-Galloway, Scotland, who were visiting Anne Arundel County, Maryland. We have many contacts with and in Scotland. During the past several years, we have visited many seaports in the United States, the Caribbean, the Pacific, and New Zealand. Last January we went to Melbourne, Sydney, and Cairns, Australia, with the Society of Naval Architects and Marine Engineers. I am retired from Vitro Corp. and now trading as Riggs Marine Appraisals, Ltd., chartered in 1972 by professionals with court-tested appraisals of marine properties, vessels and port facilities, including dry docks, on a worldwide basis." . . . **Paul B. Mentz,** S.M.'66, was appointed director of the Office of Technology Assessment of the Department of Transportation's Maritime Administration, Washington, on October 1, 1987.

Captain **Richard E. Ball,** S.M.'41 (USN, retired), a Legion of Merit recipient, passed away in Coronado, Calif., on January 13, 1988. Ball spent 33 years of active duty in the navy, commencing with a rescue of missionaries out of China on board the *U.S.S. Marblehead* in the late 1930s. Following studies at M.I.T., Ball served three years at the Brooklyn Naval Yard, supervising repairs of the *Marblehead*. He later served at Pearl Harbor, Pasagoula, Miss., Boston, and the Industrial College of Armed Forces, Wash. Ball was the first weapons systems technical director for the Bureau of Ships. As a missiles expert, Ball established a new command for the navy in 1963—the Missile Engineering Center, Port Hueneme, Calif., where he received the Legion of Merit. Following retirement in 1966, Ball was active in M.I.T. and Naval Academy alumni activities in San Diego and the Naval Academy Century Club. . . . **Charles Chia-Lai Weng,** S.M.'46, a naval architect with M. Rosenblatt & Son, Inc., New York City, passed away in January 1987; no further details are available.

XIV ECONOMICS

M.I.T. Professor **Franco Modigliani,** writing in the *Hartford Courant:* President Ronald Reagan demonstrates "a profound misunderstanding of the role of borrowing abroad. . . . It's perfectly true that borrowing abroad for the purpose of increasing one's capital may be an indication that you have good investment opportunities. But when you have capital imports resulting from and produced by a $200 billion fiscal deficit, then that is a sign of weakness in, and madness in, the government that allows that to happen."

New England will retain its enviable economic position through the rest of this year—unemployment below and wages above the national averages, says economist **Lynne E. Browne,** Ph.D.'80, vice-president of the Federal Reserve Bank of Boston in a *Boston Globe* "prospective" article. And beyond then, most analysts expect these conditions to continue for at least the rest of the decade. "Given the evidence of a strong economy, it is difficult to envision circumstances, apart from a national recession, in which the demand for labor in New England fails to keep pace with the relatively slow rate of growth expected of the labor force," writes Browne. . . . **Edward Moscovitch,** Ph.D.'66, director of the Massachusetts Municipal Association, was a speaker early this year at the inaugural ceremony for newly elected officials of Northampton, Mass.. Moscovitch was a former vice-president and director of regional economics for Charles River Associates, Boston, and Massachusetts deputy commissioner of administration for fiscal affairs.

Patricia M. Dinneen, Ph.D.'80, was appointed (January 1987) regional vice-president of British Telecom International, San Francisco. . . . **James W. Hanson,** Ph.D.'52, writes from Summit, N.J., "I am enjoying my retirement from a 30+ year career with Exxon, Inc., the last 16 serving as chief economist. In addition to economic consulting, I am a board member of the AAL in Appleton, Wisc."



L. C. Hruby



J. F. Roth

XV MANAGEMENT

Mel Horwitch, senior lecturer at M.I.T., is guest editor of the tenth anniversary issue of *Technology in Society,* an international journal of Pergamon Press. The issue (Vol. 10, No. 1, 1988) is devoted to papers given at the first international conference of the American Society for Macro-

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George W. Neuner,'66
Philip G. Koenig
Robert M. Asher, '78
Gregory D. Williams
Ernest V. Linek

A Breakthrough in Internationalizing Space

Byron K. Lichtenberg, Sc.D.'79, and Anthony Arrott, S.M.'82, made headlines early this spring with their four-year-old company, Payload Systems, Inc., of Wellesley, Mass., whose thorny mission is to profit from commercial ventures in space.

Having negotiated a contract with the Soviets, Payload Systems won the first permission ever granted by the Departments of Defense and Commerce to place U.S. commercial payloads aboard the Soviets' Mir space station.

"Chalk up another one for M.I.T.," wrote the *Boston Globe*'s Gregory A. Patterson.

With the U.S. space station years away, Mir is unique: it's the only orbiting platform on which experiments of more than a few days' duration can be performed under human supervision in the no-gravity environment of space.

Payload Systems, Inc., will put aboard Mir a series of experiments for growing protein crystals. Such crystals grow slowly; space shuttle flights, even if they were available, would not be long enough. And the experiments require occasional human intervention, so they cannot be carried on unmanned satellites.

When available late in 1989, the space-grown crystals will be analyzed for structural details that may make possible new drugs or biomaterials from U.S. laboratories. The technology is not revolutionary, and the crystals are not directly useful in new products, according to Arrott, who is Payload Systems' director of research.

Observers called the agreement a real breakthrough for the fledgling company—a milestone in the commercialization of space and especially in the use of Soviet space facilities by the United States. James Oberg, an independent specialist on Soviet space programs, sees it as the first example of what should become commonplace in the future: sharing resources so that the best facilities are available for many different experiments. "It's a real step in the right direction," he told the *Boston Globe*.

Arrott emphasized that Payload Systems' contract with the Soviets breaks new ground. This is not cooperative research, he said. "We're after a particular capability, and only the Soviets have it. . . . It's not in the competitive interest of American companies to sit on the sidelines waiting for the space station." □

Engineering in 1986, of which Horwitch was program chairman.

Gordon C. Shaw, S.M.'60, writes that he is professor, Faculty of Administrative Studies, York University, Toronto, and "as a hobby, I am president of the Muskoka Lakes Navigation Co., Ltd., operators of the 100-year-old restored passenger steamboat *Segwum* on the Muskoka Lakes, north of Toronto." . . . **Henry Fradkin,** S.M.'71, is currently Marketing Plans Manager at Ford Motor Co., Dearborn, Mich. Fradkin's primary responsibilities are to develop plans and strategies for multiple car and truck lines, to identify new product opportunities, and to develop product promotions, sales forecasts, and discount pricing packages. . . . **Judith C. Lewent,** S.M.'72, has been advanced to vice-president and treasurer at Merck & Company, Rathway, N.J. Formerly, Lewent served as executive director—financial evaluation and assistant controller. . . . **David Handmaker,** S.M.'86, writes that he is currently managing acquisitions for the trust company side of Bankers Trust, New York City, where he has been promoted to vice-president. Handmaker also notes that he has completed major renovations of his pre-war apartment in Manhattan. . . . **Fred I. Steel,** Ph.D.'65, who is now director of the Corporate Design Foundation, Boston, reports that he is the author of *Making & Managing High-Quality Workplaces,* (Teachers College Press, New York, 1987).

Captain **Winford G. Ellis,** S.M.'74 (USN), writes, "In July 1987 I took command of Submarine Squadron Six, located in Norfolk, Va. This squadron consists of ten nuclear attack submarines, a submarine tender, a submarine rescue ship, and other auxiliary craft." . . . **Burt Nanus,** S.M.'59, reports, "My book *Leaders: The Strategies for Taking Charge* (Harper & Row, 1985), co-authored with **Warren Bennis,** Ph.D.'55 (XIV), has been a business best seller in the United States and in 12 foreign-language translations. The French version, *Diriger,* won a prestigious prize as the best management book of 1986 in France." . . . When he wrote late in 1987, **John F. Coburn,** S.M.'80, and Gina were looking forward to the birth of their first child in March. Coburn has taken a new position as director of information projects and management engineering at Massachusetts General Hospital. . . . **J. Scott Armstrong,** Ph.D.'68, a professor at the Wharton School, is an expert on forecasting—president of the International Institute of Forecasters and editor-in-chief of the *International Journal of Forecasting.* . . . **Paul Appleby,** S.M.'87, is currently an associate in the Corporate Finance Department of Prudential Capital Markets and lives in New York City.

Shripad Pendse, S.M.'67, writes, "I recently married Elizabeth Shaw in India and we visited Australia in August 1987. I am now a professor of management at Saint Mary's University, Halifax, Canada. . . . **Doug Gorman,** S.M.'77, of Medfield, Mass., is president of Information Mapping, Inc., a company that improves the productivity of training materials, user documentation, policies and procedures, and memos. Gorman is married and has a two-year-old son. . . . **Len Lodish,** Ph.D.'68, writes that he has been appointed to the S.R. Harrell Chair in Marketing at the Wharton School, University of Pennsylvania. Lodish is leader of the team that won the 1987 Franz Edelman Award for Management Science Achievement, given by the Institute for Management Sciences for work at Syntex Laboratories on sales force sizing and deployment.

Leslie C. Hruby, S.M.'73, senior vice-president and co-founder of Technology Marketing Group, Acton, Mass., has been elected to the Board of Directors of John Wiley & Sons, Inc., in New York City. Hruby, an expert in sales and operations, specializes in marketing planning and technical product information and management. Before joining TMG, Hruby held a number of managerial positions in sales, marketing, engineering, and manufacturing at Digital Equipment Corp.

Senior Executives

The prestigious Perkin Medal of the Society of Chemical Industry (American Section) has gone to **James F. Roth,** '73, chief scientist and corporate research director of Air Products and Chemicals, Inc., Allentown, Pa. Roth was recognized for his outstanding work in applied chemistry, notably "his technical accomplishments and leadership in the field of catalysis and chemical process development." . . . **William E. Odom,** '77, is chairman of the Ford Motor Credit and Insurance Unit (includes Ford Motor Credit Corp., Dearborn, Mich., and First Nationwide Financial Corp., San Francisco). . . . **Abraham M. Goo,** '75, is currently president of Boeing Advanced Systems Co., Seattle. Goo was formerly president of Boeing Military Airplane Co. . . . **Robert G. Niven,** '76, now heads his own oil and gas company, focusing on oil and gas exploration and development in western Canada. . . . **William D. Betts,** '73, is manager of capital administration and energy at Dow Corning.

Walter B. Dingle, '63, employed with the Imperial Oil Co., Ltd., Alberta, Canada, from 1943 until his retirement in 1977, passed away on September 15, 1987, in Calgary, Canada. Dingle was Imperial Oil's corporate manager for Alberta prior to retiring, when he became a director of Ranger Oil, Ltd. He was involved in community and professional affairs as a past president of the United Way of Calgary, past president of the Calgary and Alberta Chambers of Commerce, and past chairman of the Canadian Petroleum Association. . . . Two deaths have been reported to the Alumni Association, with no further details available: **James R. Sylla,** '77, president of Chevron U.S.A., was killed in a commuter airline crash near San Luis Obispo, Calif., on December 7, 1987; and we have belated learned of the death of **Jack H. Pursel,** '68, of Chatham, N.J., in 1985.

XVI AERONAUTICS AND ASTRONAUTICS

Richard H. Battin, Ph.D.'51 (XVIII), a member of the Charles S. Draper Laboratory and adjunct professor at M.I.T., is the author of a new volume in the AIAA Education Series—*An Introduction to the Mathematics and Methods of Astrodynamics.* J. S. Przemieniecki, editor-in-chief of AIAA's series, describes the book as testimonial to Battin's "exceptional pioneering work as a scientist and engineer and his outstanding personal contributions to the U.S. space program." . . . **John P. Holdren,** S.M.'66, professor of energy and resources at the University of California, Berkeley, is co-editor with Professor Paul R. Ehrlich of Stanford of *The Cassandra Conference: Resources and the Human Predicament* (Texas A&M University Press, 1988, $14.95 paper, $32.50 cloth).

Robin Vaughan, S.M.'83, reports from Montrose, Calif., that she is now a member of the technical staff, Optical Systems Analysis Group, Navigation Section, Jet Propulsion Laboratory, Pasadena. . . . Meanwhile, **Stephen J. Fortune,** S.M.'81, has moved to Herndon, Va., to become director of remarketing at Saab Aircraft of America; he's responsible for the sale or lease of all aircraft taken in on trade.

Alison Brown, S.M.'81, is owner of Navstar Systems Development, Monument, Colo., a consulting activity in engineering, analysis, and integration techniques involving the GPS satellite system. . . . From Malvern, Pa., **Frank Daurio,** S.M.'70, reports that he is chief engineer in the Ground Systems Department of GE's Military and Data Systems Operation, Valley Forge.

Captain **Kenneth M. Tebo,** S.M.'47, U.S.N. (Ret.), is director of George Washington University's off-campus program of continuing engineering education; "enjoying life in Washington," he writes. . . . Also retired after 30 years in the navy is **Henry F. Lloyd,** S.M.'46, who is well into a second career in college administration at Flagler College, St. Augustine, Fla.

John E. Draim, E.A.A.'69, writes from Vienna, Va.: "My article describing a four-satellite constellation providing continuous coverage of the entire globe appeared in the September/October issue of the *Journal of Guidance and Control;* U.S. and foreign patents are pending. The constellation employs slightly elliptic high-altitude orbits in a unique and innovative arrangement. Until recently it was generally accepted that five satellites were required for this coverage. Reduction in numbers of satellites can translate into large cost savings for communications, surveillance, weather, and data relay systems."

XXI HUMANITES

A Cecil and Ida Green Career Development Professorship has been given to **Sarah J. Deutsch,** assistant professor of history at M.I.T., to recognize her teaching and scholarly research. At the Institute since 1985, Deutsch's major interests are in American history, including race relations, women's history, and other aspects of social history.

Leo Marx, William R. Kenan Jr. Professor of American Cultural History at M.I.T., is the author of *The Pilot and the Passenger: Essays on Literature, Technology, and Culture in the United States* (New York: Oxford University Press, 1988). The essays span Marx's 40-year career studying American culture as "a fruitful contest between conflicting ways of seeing the world and expressing its meaning." . . . **Gordon S. Edwards,** Sc.D.'70, writes, "I'm living in Natick, and running my own consulting firm specializing in environmental and occupational exposure to toxic substances."

Pauline Maier, professor of history at M.I.T., has started a three-year term as a trustee of Regis College, Weston, Mass. Maier received an honorary doctor of law degree from Regis in 1987; she specializes in American history and has taught at M.I.T. since 1978.

Important new funding came from the MacArthur Foundation to two projects in the Program in Science, Technology, and Society late last year:
□ $88,000 for research on a computer model for analyzing nuclear arms reductions by the Program in Science and Technology for International Security, under the direction of **Kosta Tsipis.**
□ $40,000 for a continuing study of computing in the Soviet Union and its significance for peace and security, by Professor **Sherry R. Turkle.**

From the J. Paul Getty Trust of Los Angeles, a $394,000 grant for research on the art and artifacts of pre-Columbian America and pre-colonial Africa. There will be studies comparing ancient and modern art and artifacts in Ecuador and Peru and in Zaire and Zimbabwe under Professor **Heather Lechtman,** director of the M.I.T.-based Center for Materials Research in Archaeology and Ethnology.

The efforts of Mikhail Gorbachev to restructure Soviet science and engineering are the subject of **Loren R. Graham,** professor of the history of science at M.I.T., in *Issues in Science and Technology* (winter 1988).

XXII NUCLEAR ENGINEERING

After nearly a decade with the Office of Scientific and Weapons Research of the Central Intelligence Agency, **Frederick A. Kautz II,** Nu.E.'83, moved to M.I.T.'s Lincoln Laboratory last fall; he is a staff member in Group 73 (aerospace engineering) and lives in Harvard, Mass.

The first flight of the space shuttle following its long standby for re-engineering the rocket seals will be under the command of **Frederick H. Hauch,** S.M.'66. Hauch became a navy combat and test pilot after leaving M.I.T., joined the astronaut corps in 1978, and flew the shuttle on two flights in 1983 and 1984. . . . Captain **Mario P. Fiori,** Ph.D.'69, is now commander of the Naval Underwater Systems Center, Newport, R.I.; his previous assignment (since 1985) was as commander of Submarine Squadron Four, Charleston, S.C. . . . The first Elvera and William Stuckenberg Professor of Technology and Human Affairs at Washington University, St. Louis, is **Robert P. Morgan,** Nu.E.'61; Morgan has been at WU since 1968, developing research and teaching programs on social applications of technology.

Donald H. Korn, S.M.'60, principal of DHK Associates, is among the authors of a new edition of *The Bank Director's Handbook* (Auburn House, Dover, Mass., 1987, $32); its purpose is to keep bank officials current with regulations, technology, and marketing strategies in the banking industry. . . . From Paris, **Jean Paul Raoul,** S.M.'70, writes: "Brennus, the technical consulting company I started seven years ago, is quite active in new methods for maintenance of nuclear power and water treatment plants. Paris is living intensely again; my friends from M.I.T. are cordially welcome to call me if they find themselves in the area."

Robert C. Marlay, Ph.D.'83, is the author of "Industrial Electricity Consumption and Changing Economic Conditions" in *The Changing Structure of American Industry and Energy Use Patterns* (Battelle Press, 1987). Marlay is special assistant to the deputy assistant secretary for conservation in the Department of Energy; the book is the proceedings of a 1985 EPRI seminar.

Joseph Sasson, S.M.'85, writes from Antony, France: "I am working on a graphic seismic interpretation software for the major geophysical company in France, Compagnie Generale de Geophysique. It is developed on the HP-9000 and also a Micro Vax with graphic monitors made in Boston by Raster Technologies." Though most readers might envy Sasson on assignment in France, even that reference to Boston inspired nostalgia: "God, how I miss that city . . . and M.I.T.!" . . . **King-Wo T. Chiu,** S.M.'80, is working in Hong Kong as a product manager in an electronic company.

Technology and Policy Program

As the year concludes, awards have been announced for excellence in the program to three graduate students:
□ **Steven Farber** holds the $1,000 Award for Excellence and Leadership endowed by program alumni; he was cited for his role in student discussion of the influence of campus military research. While studying in the program, Faber is also working for a doctorate in the Department of Brain and Cognitive Sciences on the effects and management of food additives.
□ **Isna Soedjatmoko,** S.M.'87, was recognized for her thesis on "Technological Choice for Developing Countries: The Case of Remote Sensing of Earth Resources," directed by Professor Herbert Einstein in the Department of Civil Engineering.
□ **Alice Outwater,** S.M.'87, who held a Champion International Corp. fellowship, was cited for her thesis on "The Political Determination of Water Quality Standards."

Carol Eberhard, S.M.'82, is a senior policy analyst with the Nuclear Regulatory Commission, responsible for NRC's liaison with other U.S. government agencies for international safeguards and U.S. support for the International Atomic Energy Agency's safeguards inspectorate. . . . **Herve Hillion,** S.M.'86, was recently in the U.S. for three months of collaborative research with the University of Maryland in production management. He has returned to France with INRIA (Lorraine).

Kevin Fitzgerald, S.M.'86, is a researcher in the Household Energy Unit of the UNDP/World Bank Energy Sector Management Assistance Program. He is currently managing a household energy strategy study in Indonesia and coordinating a seminar on household energy planning for officials of government agencies in Eastern and Southern Africa.

We report with pride that **Peter Cebon,** a second-year Australian student in the program, has won the 1988 $5,000 Marvin Goody Prize. His award is for the excellence of his project on "Nontechnical Factors in University Management," an analysis of why universities use more energy than other comparable organizations and the constraints on university energy conservation.—Richard de Neufville, Chairman, Technology and Policy Program, M.I.T., Rm. 1-138, Cambridge, MA 02139

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The unconventional approach of Richard P. Feynman, '39, was nowhere better exemplified than during his service as a member of the Rogers Commission on the space shuttle Challenger.

Richard P. Feynman, 1919-1988
Aberrant, Brilliant Physicist

Richard P. Feynman, '39, Richard Chace Tolman Professor of Physics at California Institute of Technology, died on February 15 after an eight-year battle with abdominal cancer. He was 69.

Feynman was a distinguished physicist, winner of the 1969 Nobel Prize for theoretical work in quantum electrodynamics. But his fame rests more on his unconventional and sometimes irreverent approach to his profession—and, indeed, to all aspects of his life.

The most recent well-known example of his uniquely direct approach came when Feynman grew frustrated and impatient with the formalities imposed on him and his colleagues on the Rogers Commission studying the loss of Challenger in 1986. So Feynman did his own research and interviewing on the principal issues, including a test in ice water of the controversial O-ring material, and he wrote his own report to supplement that of the commission.

Feynman's reminiscences, published in 1985 under the title *Surely You're Joking, Mr. Feynman*, were on the New York Times best-seller list for 14 weeks. He was also the author of a popular account of his work in quantum electrodynamics, *QED: The Strange Theory of Light and Matter* (1986), and of a leading physics text, *The Feynman Lectures on Physics* (1963).

Philip Morrison of M.I.T. told United Press International that Feynman was "the most original theoretical physicist of our time." And Marvin Goldberger, former president of Caltech, described Feynman as "a towering figure in 20th-century physics." □

Perry Moon, 1898-1988:
At M.I.T. for 64 Years

Professor Perry Moon, S.M.'27, who made notable contributions to illuminating engineering and other fields as a member of the Department of Electrical Engineering from 1924 until a few days before his death, succumbed to pneumonia in Boston on March 4; he was 90.

Moon came to M.I.T. following undergraduate studies at the University of Wisconsin and two years of work at Westinghouse. As a graduate student, he was an assistant to Vannevar Bush, '16, working on high-voltage insulation.

Soon after receiving his master's degree, Moon was asked to develop courses in lighting and illumination, subjects not then included in M.I.T. curricula. This assignment led to a life-long professional career, including several successful books in the field, and to a partnership with one of his students, Domina Eberle Spencer, '39, whom he married in 1961.

Together, Moon and Spencer—she taught at the University of Connecticut—published hundreds of papers on light, vision, and color. In 1973 they were honored jointly by award of the Gold Medal of the Illuminating Engineering Society of America. Their most recent book, *Theory of Colors*, came from Cambridge University Press in 1986.

Until the onset of his last illness early this year, Moon was active at M.I.T., deeply involved in research on alternative formulations of electrodynamics. □

Deceased

The following deaths have been reported to the Alumni Association since the *Review*'s last deadline:

Donald A. Young, '50; June 11, 1987; New Vernon, N.J.
William H. Catha, '52; February 16, 1987; Jacksonville, Fla.
Warren G. Nelson, '53; July 22, 1987; Weston, Mass.
Ho Y. Whang, '61; October 6, 1986; Paramus, N.J.
Walter B. Dingle, '63; September 15, 1987; Calgary, Canada.
Michael P.W. Lum, '68; May 11, 1986; Dresher, Penn.
Joseph W. Kennedy, '69; January 4, 1988; Millsbury, Mass.
John Lai-Yee Tom, '73; January 20, 1975; Jackson Heights, N.Y.
Daniel G. Theriault, '81; December 7, 1987; Leominster, Mass.
Gregory M. Lawton, '86; March 1987; Dundas, Australia.
Gardner C. George, '11; December 1, 1987; Coconut Creek, Fla.
Walter J. Beadle, '17; February 8, 1988; Kennett Square, Penn.
Conrad H. Hedin, '19; December 14, 1985; Middleboro, Mass.
Alfred A. Fraser, '20; March 6, 1988; Wellesley, Mass.
Abraham E. Shlager, '20; 1985; Center Harbor, N.H.
Henry R. Hatch, '21; October 9, 1986; Cleveland, Ohio.
Walter W. Kittredge, '21; February 27, 1988; Cheshire, Conn.
Donald B. McGuire, '21; December 27, 1987; Falmouth, Maine.
Frank N. Houghton, '22; March 9, 1988; Elmwood, Mass.
Richard M. Rush, '22; September 26, 1987; Essex, Mass.
Arne H. Ronka, '23; December 10, 1987; Rockport, Mass.
Robert J. Yaffey, '23; 1979; Miami, Fla.
Godfrey G. Kearful, '24; 1987.
William A. McCartney, Jr., '24; 1988.
Christos Harmantas, '25; December 30, 1987; Bethesda, Md.
James W. McGuire, '25; November 29, 1987; New York, N.Y.
William H. Borghesani, '26; June 12, 1987; Lexington, Mass.
James R. Killian, Jr., '26; January 29, 1988; Cambridge, Mass.
William H. Latham, '26; January 15, 1987; Lewiston, N.Y.
Abraham White, '26; October 23, 1987; Brookline, Mass.
Parry H. Moon, '27; March 4, 1988; Boston, Mass.
Arthur F. Tallman, '27; December 5, 1987; Spring Valley, N.Y.
Kenneth G. Gove, '28; January 14, 1988; Winter Haven, Fla.
Stephen N. Dilworth, '29; January 20, 1988; Newport Richey, Fla.
John F. Joyce, '29; November 24, 1987; Drexel Hill, Penn.
Horace W. Myers, '30; March 23, 1987; Land O Lakes, Fla.
Robert T. Leadbetter, '31; June 6, 1988; Branford, Conn.
Francis E. Wolosewick, '31; July 6, 1987; Chicago, Ill.
Lester Glickman, '32; October 9, 1987; North Miami Beach, Fla.
George H. Sistare, Jr., '32; December 30, 1987; Fairfield, Conn.
Zebulon L. White, Jr., '32; 1987; Jenkintown, Penn.
Warren J. Henderson, '33; February 28, 1987; Boca Raton, Fla.
Donald A. Thompson, '33; August 3, 1987; Baltimore, Md.
Mrs. Philip A. Daniel, '34; December 14, 1987; Grand Junction, Colo.
Tsutomu Kamijo, '34; 1982; Tokyo, Japan.
Aldo A. Minotti, '34; February 6, 1988; Winchester, Mass.
John D. Viola, '36; December 1, 1987; Westwood, Mass.
John G. Booton, Jr., '37; November 9, 1987; Sellingsgrove, Penn.
William E. Burns, '37; June 22, 1987; Amherst, N.H.
Willard Roper, '38; 1986; Sedona, Ariz.
Joel B. Hoberman, '39; February 5, 1988; Bethesda, Md.
Albert S. Roberts, '39; November 14, 1986; Rector, Penn.

ALLAN J. GOTTLIEB

A Nontrivial Bet: Poker Face vs. High Roller

This introduction will be short, containing just three short contributions from you, the readers. Jonathan Aronson was looking through an old *Technology Review* and read the solution given for finding the radius of a sphere circumscribing a regular tetrahedron. He found an alternate solution using the trick of inscribing the tetrahedron in a cube and points out that other properties of the tetrahedron can be derived quickly using this trick.

Greg Huber adapted an argument of his based on the four 4s problem to show that if our yearly problem is expanded to permit logs and square roots, then any integer can be expressed using the digits 1,9,8,8. Robert Bart notes that the yearly problem is in for hard times, since until 2134 all years will have repeated digits or a zero. Although Bart suggests loosening the rules, I prefer to sit tight and wait it out until 2134.

Problems

M/J 1. We begin with a Bridge problem from Doug Van Patter:

North
♠ 4 3
♥ K 7 6
♦ A Q J 5 2
♣ K Q 5

South
♠ K 6
♥ J 10 8 5 3 2
♦ K 7
♣ A 6 4

Bidding

N	E	S	W
1D	1S	2H	Pass
3H	Pass	4H	Pass
Pass	Pass		



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012.

M/J 2. Our next problem is from Matthew Fountain, usually a sure bet:
Two gamblers, High Roller and Poker Face, love to gamble but not with each other, as High Roller always wins at dice and Poker Face always wins at cards. A mutual friend suggests a fair and nontrivial bet that they could make. Each could privately write three amounts adding to $1,000 on a slip of paper. Then they could compare their amounts, the largest against largest, the smallest against the smallest, and the median against the median. The one with the larger amount in two of these three comparisons would win the bet and take the $1,000. Can you help Poker Face decide what to write on his slip?

M/J 3. Inspired by **1987 F/M 5,** John Weissberg has a roller coaster problem:
Imagine a roller coaster with a ruler, initially pointing straight up, balanced on it. Even ignoring air drag, the ruler's attitude is unstable, and it will eventually fall over. Is there a path, e.g. a series of hills and loops, for the coaster such that the ruler's attitude remains stable and it will not fall over?

M/J 4. Sidney Shapiro believes (suspects?) that he has an interesting problem:
Four suspects, each of different height, are in a house surrounded by a posse. The actual criminal is known to be the tallest. The sheriff is constrained to make only a single arrest. The suspects can be arrested only as they leave the building. They do so one at a time. Which suspect—the first to leave, the second, etc.—should the sheriff arrest?

M/J 5. Richard Hess has a point, a line, a compass, and a straight edge. He wants to construct the perpendicular to the line through the point using the compass only once and the straight edge as many times as necessary.

Speed Department

SD 1. Here is one from Jim Landau. The mathematical connection is admittedly very tenuous but we both like it:

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George Washington turned down an offer to become king of the Colonies and became our first president instead. However, without compromising his democratic principles, he could still have chosen to style himself President George I. In that case, can you identify the following Presidents:

1. Franklin I
2. Hiram I
3. James V
4. Thomas II
5. Leslie I

SD 2. Thomas Harriman notes that in a game of backgammon your opponent may offer to double the stake once (unless you double him back): if you refuse the offer, you immediately lose the original stake. How low can your probability of winning be and still have it advantageous to accept?

Solutions

JAN 1. You are in a four-spade contract and take the opening lead of ♥2 in dummy. Assuming rubber bridge with neither side vulnerable, how do you play the trumps? What if match points are being used?

Dummy
♠ 5
♥ A K 8
♦ Q 9 3
♣ A K 8 6 5 3

Declarer
♠ A K 10 9 8 7 2
♥ 6
♦ J 10 8 6
♣ Q

Our first solution is from Richard Hess, who notes that at trick two South can either take the trump finesse or go for the drop. The only distributions of opponents' trumps that give different outcomes for the two options are shown in the following table.

East	West	Drop	Finesse	Probability
x	QJxx	Make 9	Make 10	.08478
Q	Jxxx	Make 10	Make 9	.02826
J	Qxxx	Make 10	Make 9	.02826
QJ	xxx	Make 11	Make 10	.033915

In rubber bridge it is better to finesse, giving a higher probability of making game. With match points, however, it is better to play for the drop, having a probability of .090435 of bettering opponents who take the finesse and having a probability of only .08478 of being bettered by such opponents.

Also solved by Robert Bart and the proposer, Douglas Van Patter.

JAN 2. Compute the natural logarithms of the integers from 2 to 10, using pencil and paper *only* (no calculators, computers, or numeric tables), to four decimal places of accuracy.

We offer two different solutions. William Waite sent in a solution done with pen and paper (including all long divisions, which we have omitted). He begins with the Taylor series

$\ln[(1 + x)/(1 - x)] = 2(x + x^3/3 + x^5/5 + x^7/7 + x^9/9 \ldots)$.
Letting $x = 1/3$ we get
$\ln 2 = 2(1/3 + 1/81 + 1/1215 + 1/5309 + 1/177147 + \ldots) = 0.69315$.
Now let $x = 1/5$. This time we need only four terms to see that
$\ln(3/2) = 0.40546$
and hence
$\ln 3 = \ln(3/2) + \ln 2 = 1.09861$.
Naturally,
$\ln 4 = 2 \times \ln 2 = 1.38630$.
Now let $x = 1.9$ and keep three terms to get
$\ln (5/4) = 0.223142$
and hence
$\ln 5 = \ln(5/4) + \ln 4 = 1.60944$.
Also
$\ln 6 = \ln 2 + \ln 3 = 1.79176$.
Finally let $x = 1/6$ and keep four terms to get
$\ln(7/5) = 0.336474$
and hence
$\ln 7 = \ln(7/5) + \ln 5 = 1.94591$.
The rest is easy
$\ln 8 = \ln 2 + \ln 4 = 2.07945$
$\ln 9 = 2 \times \ln 3 = 2.19722$
$\ln 10 = \ln 2 + \ln 5 = 2.30259$.

Our second solution, from John Chandler, uses different Taylor series. Mr. Chandler writes (actually sends via electronic mail):

$e^x = 1 + x + x^2/2 + x^3/6 + \ldots$ (1)

and

$\ln(1 + x) = x - x^2/2 + x^3/3 - x^4/4 + \ldots$ (2)

Equation (1) shows a simple way of computing (which I assume we must not simply look up!): $1 + 1 + .5 + .1666667 + .0416667 + .0013889 + .0001984 + .0000248 + .0000027 = 2.7182815$, which gives us the base of natural logarithms to 5+ decimal places. Since equation (2) doesn't converge very fast for $x=1$, let's try a short cut: squaring e gives 7.38904 (to 5 places), and this is reasonably close to 7. In fact, it's 7*1.05558. We can save a bit of multiplying by noticing that .05558 is very close to 1/18, certainly close enough for plugging into equation (2): $\ln(1.05558) = .05558 - .00155 + .00006 = .05409$, so
$\ln 7 = 2 - \ln(1.05558)$, and hence $\ln 7 = 1.94591$.
Now, $7/8 = 1 - 1/8$, so plugging that into equation (2) gives:
$\ln(7/8) = -.12500 - .00781 - .00065 - .00006 = -.13352$, so
$\ln 8 = \ln 7 - \ln 7/8$, and hence $\ln 8 = 2.07943$.
$\ln 2 = (\ln 8)/3$, and hence $\ln 2 = 0.69314$.
$\ln 4 = \ln 8 - \ln 2$, and hence $\ln 4 = 1.38629$.
Next, $49/50 = 1 - .02$, so that gives:
$\ln(49/50) = -.02000 - .00020 = -.02020$, but
$\ln 49 = 2*\ln 7 = 3.89182$.
So $\ln 50 = 3.91202$, and
$\ln 25 = \ln 50 - \ln 2 = 3.21888$.
Hence $\ln 5 = 1.60644$.
Also, $\ln 10 = \ln 5 + \ln 2$, and hence $\ln 10 = 2.30258$.

Finally, 81/80 = 1 + 1/80, and plugging that into equation 2 gives:
ln 81/80 = .01250 − .00008 = .01242.
But ln 80 = ln 8 + ln 10, ln 80 = 4.38201, so ln 81 = 4.39443. So
ln 9 = (ln 81)/2, and hence ln 9 = 2.19722.
ln 3 = (ln 9)/2, and hence ln 3 = 1.09861.
ln 6 = ln 3 + ln 2, and hence ln 6 = 1.79175.

Also solved by Norman Wickstrand (who also showed that the antilogs (base 10) of 0, 0.1, 0.2, 0.3, . . ., 1.0 can all be computed easily within 1% by remembering two approximations: log2 = .3 and logπ = .5), Chip Whiting, Harry Zaremba, Richard Hess, Jonathan Aronson, Robert Bart, and the proposer, Jim Landau.

JAN 3. It is possible to obtain all the integers from 1 to 40 by adding and subtracting various combinations of only four different integers. What are these four integers?

Louis Wadel actually shows (slightly) more than twice what was required:
The answer is 1, 3, 9, 27. This can be seen easily by considering a 4-digit base 3 number, dddd, where each digit can have the value 0, +1, or −1. A given number then represents the absence, or the positive, or the negative presence of 27 ($=3^3$), 9, 3, or 1. Thus all integers from −40 to +40 can be represented, a total of 81 = 3^4 numbers.

Also solved by Raymond Gaillard, Sidney Williams, Harry Zaremba, Jim Landau, Richard Hess, Jonathan Aronson, Douglas Ell, Ken Rosato, Greg Spradlin, and Robert Bart.

JAN 4. ***"The 20th Anniversary Party"*** The hostess told me the youngest of her three children likes her to pose this problem, and proceeded to explain. "I normally ask guests to determine the ages of my three children, given the sum and product of their ages. Since Smith missed the problem tonight and Jones missed it at the party two years ago, I'll let you off the hook." Your response is "No need to tell me more, their ages are. . ."

Our final solution is from Robert Buegler. Copies of his program and its output are available from the editor. Mr. Buegler writes:
I've enjoyed your puzzles for a number of years but have never sent in a solution. This one intrigued me and presented an unusual challenge. I must congratulate Richard Hess for his rapid and "intuitive" response: "No need to tell me more, their ages are . . ." I could neither come to an intuitive conclusion nor see an elegant solution and decided to tackle it brute force with a Basic program on my PC. I thought there might be more than one possible solution, but after refining my approach, concluded that there was a single solution based on the following assumptions:
a. At the 18th Anniversary, the minimum age of the youngest child was 2, since that seemed to be the limit for a child to enjoy a game; and
b. The maximum age of the oldest child was 17, since this was the 18th Anniversary, and it didn't seem proper to impugn the moral integrity of the hostess.
The correct solution by Hess, at the 20th Anniversary party, was that the three children's ages were 5, 6, and 16.

To summarize briefly: In order for Jones and Smith to have incorrect solutions there had to be, at each Anniversary, two possible age combinations with the same sum and product. For each age sum from minimum to maximum at the 18th Anniversary, the program first develops an array of all age combinations with that sum. Each such array is then checked for those sums which have like products, which are stored as pairs in a second array. This process is repeated for the 20th Anniversary. The program prints the resultant pairs for each array. The program then compares the age group for each entry in the 18th Anniversary array, incremented by 2 years, with the entries in the 20th Anniversary array. For each correct match, the result is printed out, annotated as to which are the correct and incorrect solutions. The printed results demonstrate that there is only one correct solution.

Also solved by Robert Bart, Ken Rosato, Steven Feldman, Jonathan Aronson, and the proposer, Richard Hess.

Better Late Than Never

1987 OCT 2. W. Messner has responded.

OCT 4. Tracy Wichmann has responded.

N/D 1. Nathan Glasser and W. Messner have responded.

N/D 2, N/D 3. Nathan Glasser has responded.

N/D 4. Nathan Glasser and W. Messner have responded.

N/D 5. Nathan Glasser has responded.

Proposers' Solutions to Speed Problems

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SD 2. 25%.

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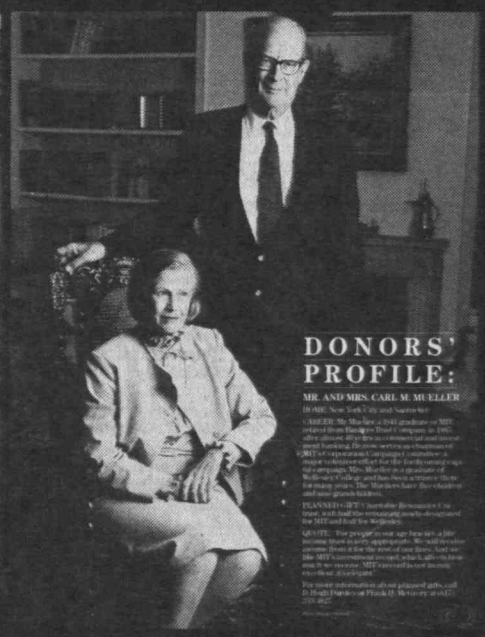
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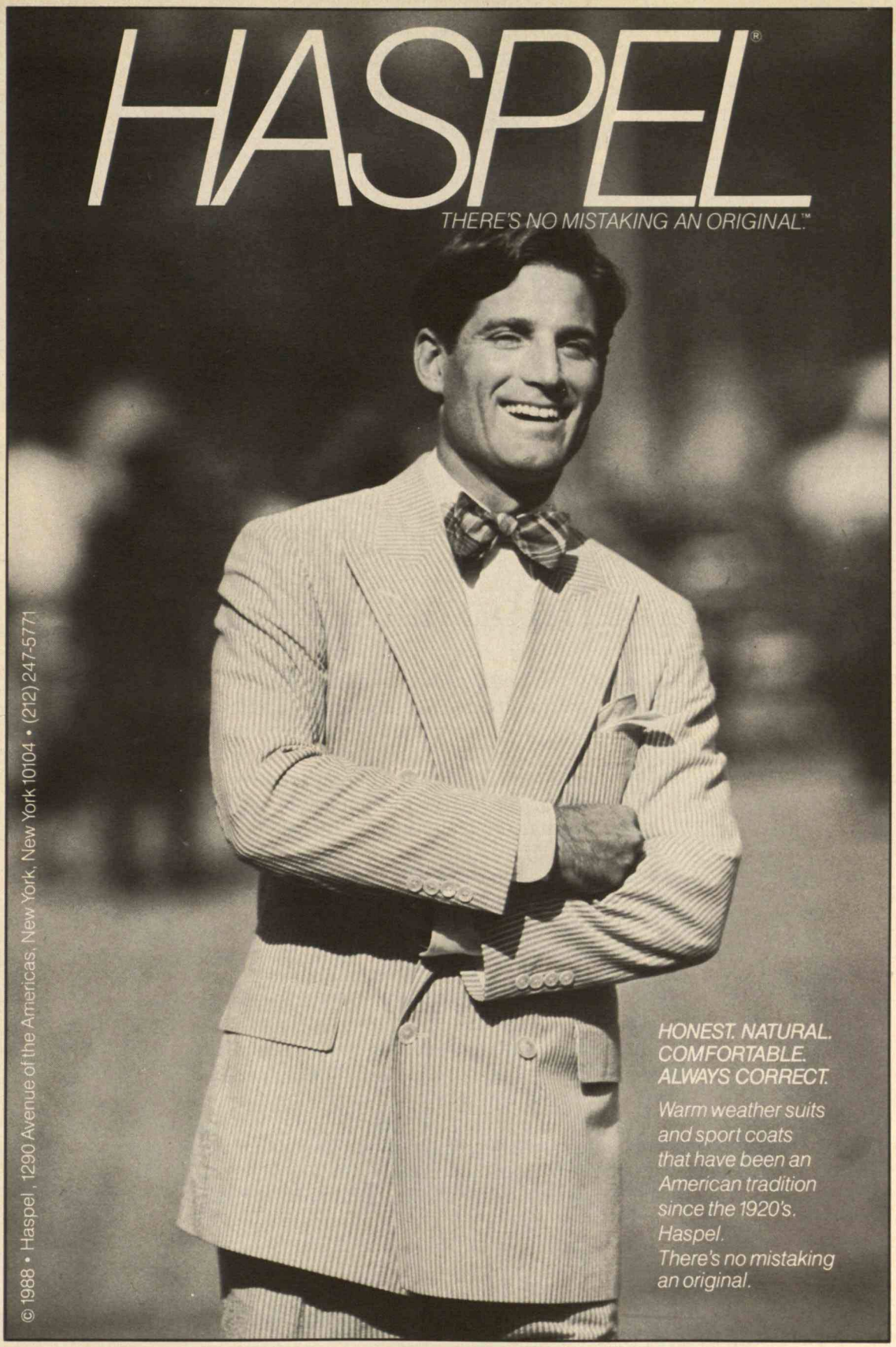












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New electronic technologies have redefined intellectual property, posing economic and ethical dilemmas for scientists, policymakers, and the public.

Who Owns Creativity?

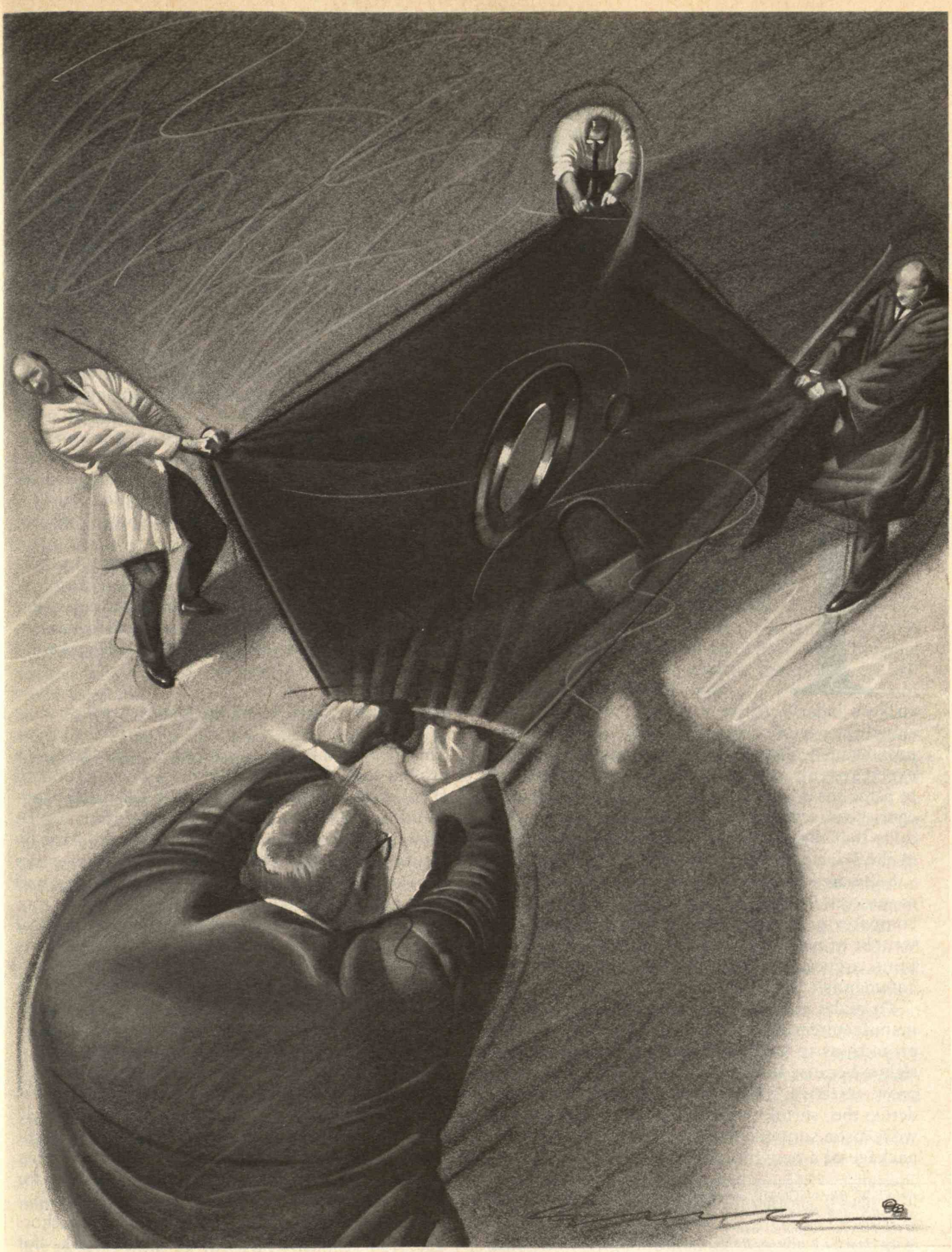
Property Rights in the Information Age

In the coming months, a Boston, Mass., federal district court may settle a $10 million lawsuit by deciding who owns the "look and feel" of a popular computer program. The result will only intensify the controversy over the impact of new information technologies on intellectual property rights.

In January 1987, the Lotus Development Corp. filed suit against two small software houses for violating its copyright on the enormously successful Lotus 1-2-3 computerized spreadsheet. The defendants had developed and marketed "work-alike" spreadsheet programs that incorporate the program functions and screen design of 1-2-3 without duplicating the programming code traditionally protected by copyright. Nevertheless, Lotus argued that the work-alike programs are unauthorized copies. The name of one clone is—revealingly—"Twin," and an advertisement for the other boasts that it is "a feature-for-feature work-alike for 1-2-3 . . . designed to work like Lotus . . . keystroke for keystroke." According to Lotus, the essence of a program is not its code but its distinctive "look and feel," which the copyright should protect.

BY ANNE W. BRANSCOMB

ILLUSTRATIONS: SALLY WERN COMPORT



Electronic technologies make copying intellectual property easier and legal protections harder to enforce.

The defendants disagreed. From their perspective, the work-alikes are not imitations but innovations, providing all that Lotus offers and more and at a lower price. Indeed, what the defendants have done is not so different from what Lotus did some five years ago when it built upon the first computerized spreadsheet, Visicalc, to create a technically superior product.

Ironically, three months after Lotus filed its suit, the company itself became the defendant in another copyright-infringement case, this time brought by the parent company of the firm that created Visicalc. The claim was that Lotus had borrowed the look and feel of the original spreadsheet.

The desire of individuals—and corporations—to profit from their own intellectual creativity has often clashed with the public's wish for relatively free access to ideas and innovations. Over the centuries, many different legal mechanisms have been invented to strike a balance between the two. However, what suited the age of print and mechanical inventions is proving inadequate to that of the computer program, expert system, and distributed database. The attempt to force these new technologies into outmoded categories can create absurd and contradictory situations that threaten to undermine public confidence in the principle of intellectual property rights itself.

Software is a good example. Copyright is designed to protect literary expression. But what makes a computer program a literary work? Is it the code written to make the program function? Or is it, as Lotus argues, the look of the screen and feel of its commands?

To make matters even more confusing, software manufacturers simultaneously employ other legal protections to safeguard their intellectual property rights, because they are doubtful that any one will prove effective. The principle of trade secrets underlies the "shrink-wrap license" to which every software user supposedly agrees upon opening the package of a new program.

ANNE W. BRANSCOMB, an attorney specializing in communications, computer, and copyright law, is adjunct professor of international law at the Fletcher School of Law and Diplomacy and a research associate of the Harvard University Program on Information Resources Policy.

Some computer programs are also eligible for patents, most notably software embedded in computer hardware. And while operating systems that are not built into hardware have traditionally been excluded from patent protection, the U.S. Patent Office has recently been considerably more lenient toward such applications.

As the forms of protection increase, the gap between legal precedent and everyday behavior grows wider. The new technologies make copying intellectual property easier and legal protections much more difficult to enforce. Some degree of unauthorized copying has become accepted social practice—despite the legal prohibitions against it: journal articles are photocopied at universities, recorded music is taped onto blank cassettes, and computer software is commonly reproduced.

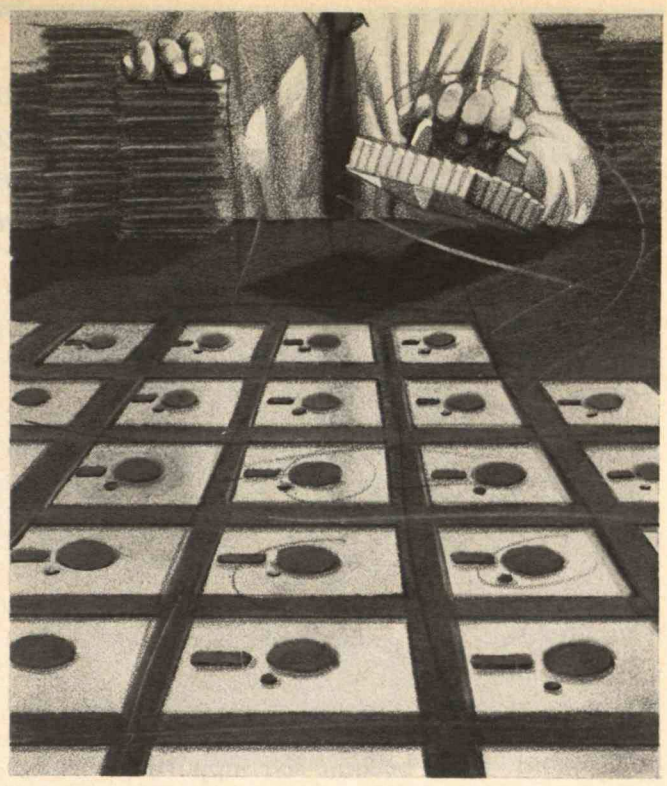
Although disputes about technology and intellectual property are usually cast in narrow legal terms, they are intimately related to public attitudes. Realistic legal rules depend upon a social consensus about what kind of behavior is acceptable and what is not.

"To Promote Science and the Useful Arts"

The idea of intellectual property rights has been around since the late Middle Ages, but the roots of U.S. intellectual property law go back to the Constitution: "The Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writing and Discoveries."

As this language suggests, the fundamental goal of intellectual property rights is not to benefit the creators of works but to further the public good. Authors and inventors are given a limited right to their work as an incentive to create and disseminate ideas and information. Thus, intellectual property law makes protection conditional on public disclosure.

For example, copyright law covers original "works of authorship" as long as they are "fixed" in a "tangible medium" such as a book. Copyright protects the literary expression of an idea, rather than the idea itself, from unauthorized copying for the life of the creator plus 50 years (or, for corporations, for a total of 75 to 100 years). Other authors can make "fair use" of a copyrighted work—for



example, quoting a passage in an article or review—without asking the original author's permission. More extensive use requires permission and often the payment of a royalty.

Patent law protects inventions or discoveries that are registered with the U.S. Patent Office. Unlike copyright, a patent protects not only the expression but the actual useful features of a product or process for 17 years. A design receives protection for 14 years. Patent rights grant a monopoly, good against those who independently discover the same design or product. But rights can be licensed to other users.

However, a patent is much harder to get than copyright. To be eligible for patent protection, a work must have distinguishing features that are innovative, useful, and not obvious. And the application process often takes two years or more.

Not all forms of intellectual property protection require public disclosure. The oldest and probably most common form of protection is secrecy. Trade secrets are protected by contracts designed to ensure confidentiality on the part of licensed users. To be enforceable in court, the information considered a trade secret must be used commercially and relevant to a firm's competitive advantage. Also, the firm must have evidence that it has actively attempted to keep the information secret.

The Intellectual Property System Breaks Down

These traditional mechanisms for balancing public and private claims worked relatively well during the industrial era. As long as the publication of books and journals depended on a relatively small number of commercial printers, it was easy to identify copyright violations. As long as most industrial innovations had a relatively long life, the patent process successfully protected their economic value. And as long as most violations took place either within a single nation or between nations with relatively compatible legal systems, effective sanctions could be easily enforced.

Recently, however, three interrelated factors have eroded the effectiveness of traditional protection mechanisms: the development of new information and communications technologies, the globalization of the marketplace, and the privatization of information providers.

The traditional categories of intellectual property law depend on a set of clearly defined "products" or "processes"—literary works, inventions, designs, etc. But with the new technologies, boundaries between media are blurred and intellectual assets become increasingly abstract and intangible. The same work or even parts of a work can be stored and presented in a bewildering variety of forms—not only paper, but magnetic tape, floppy disc, or laser disc. The work can be made available to large numbers of people via broadcasting, computer networks, or telephone lines. Databases can be packaged and re-packaged. Pieces of music or video images can be electronically re-mixed, re-formatted, or otherwise altered. And easy-to-use technologies like video graphics and desk-top publishing allow more individuals and small businesses to enter the information marketplace than ever before, making enforcement of intellectual property rights nearly impossible.

The globalization of the world economy, caused partly by the new technologies, has also contributed to the breakdown of the old system. International conflicts over intellectual property have always been a problem, as developing countries, anxious for economic growth, have been unwilling to extend protection to foreign works. This was true of nineteenth-century America, and it is true of much of the Third World today.

But the increasing integration of the world economy has multiplied both the incentives for international violations of intellectual property rights and the economic harm of such violations. Today, the products of newly industrialized countries such as Korea or Taiwan are sold all over the world. "Bor-

To consider a computer program used by millions a "trade secret" offends common sense.

rowing" intellectual property allows these countries to successfully compete in markets for many advanced products without bearing the cost of research and development.

Finally, the growing trend toward using market mechanisms to gather and disseminate information has disrupted the traditional public infrastructure for sharing intellectual assets. For example, before the breakup of the regulated Bell Telephone system, Bell Labs was the equivalent of a national basic-research laboratory, supported by corporate cross-subsidies. Today, institutions like Bell Labs face growing pressures to pay their own way. The federal government has mandated that agencies such as the National Technical Information Service and the National Library of Medicine become self-supporting through user fees. And even universities are turning to patent rights and copyright royalties to recoup their investment in faculty research and development.

The High Costs of Copying

Thus, at the very moment when information is becoming a valuable commodity, protecting the economic value of intellectual assets is proving more difficult. While the loss of income is difficult to ascertain, estimates range anywhere from $20 billion to $60 billion each year.

Most serious is the deliberate commercial pirating of both low- and high-tech products in foreign countries. For example, videotaped copies of Hollywood films are often illegally released in foreign markets before the U.S. release. The Motion Picture Association of America estimates the loss at about $6 billion annually. And illegal publishing of books and technical manuals abroad costs the American publishing industry about $1 billion every year. In Korea alone, nearly 1 million U.S. titles have been pirated.

Other violations of intellectual property rights—for personal rather than commercial use—are more difficult to track. The rule of thumb in the software industry is that at least one unauthorized copy exists for every authorized sale of a software program. According to the Software Publishing Association, software manufacturers lost approximately $1 billion in sales to piracy (both for profit and for personal use) in 1986. Lotus claims that over half of its potential sales of 1-2-3 are lost—at a cost of about $160 million every year. And Wordstar estimates that in 1984 it lost $177 million in potential sales, compared with $67 million in revenues from actual sales of the program.

Such reports need to be taken with a grain of salt, as they assume that every user of an unauthorized copy would buy the program in question were the copies to disappear—an unlikely proposition. Still, the numbers suggest the scope of the problem.

Violations of intellectual property also have public costs. Widespread copying is one factor in high software prices, as firms try to recoup their investment in a program as quickly as possible. If unauthorized copying could be eliminated, it is likely that the costs of software could be greatly reduced—a net gain for society as a whole.

Owners of intellectual property have tried a variety of methods to combat unauthorized copying. In some cases, technology itself seems to offer a solution. To stop satellite-dish owners from capturing broadcast signals without subscribing to local cable services, programmers scramble their signals. Today, the most popular programs cannot be received by satellite unless viewers pay a monthly fee to gain access to the special code of each cable channel.

However, technical protections can spawn their own technical countermeasures or result in a consumer backlash. For example, the practice of "copy protection," once widespread in the software industry, has given birth to special programs whose sole purpose is to override copy-protection code. And consumer dissatisfaction with the inconvenience of using copy-protected software has led most software companies, Lotus included, to give up on copy protecting their programs altogether.

On the international front, the federal government has encouraged trading partners to enact intellectual property laws or expand coverage of laws that already exist. Under recent provisions in trade and foreign aid laws, countries whose copyright and patent practices do not conform to U.S. standards can be penalized, even to the point of restricting their imports to the U.S. market. The federal government is also promoting a multilateral agreement on intellectual property as part of the Geneva Agreement on Tariffs and Trade.

So far, such efforts have had only limited effect.

The sanctions available to federal trade officials are miniscule compared with the enormous profits foreign companies can make by using U.S. processes and designs in the international market. Even money damages and confiscation of goods are simply absorbed by pirate firms as a cost of doing business.

Copyrighting the User Interface?

In the absence of effective protection, owners of intellectual property have tried to fit their products into any and all of the available legal categories. The results are legally contradictory and confusing to the general public. They also undermine traditional rationales for intellectual property protection.

For years, the legal status of computer programs was unclear. Although the U.S. Copyright Office began tentatively registering software under its "rule of doubt" provision in 1964, many analysts suspected that computer code written to be read by a machine rather than a human couldn't qualify for copyright. And the Patent Office considered most programs a collection of algorithms—which, like other mathematical equations, are excluded from patent protection.

So the computer software industry relied primarily on trade secrecy. This has worked reasonably well for larger computer installations with custom-made software. However, the mass distribution of easily available software made possible by the personal computer created a new legal situation.

Any personal computer user has seen the long and complicated agreement, usually set in type so small that it is barely legible, on the cover or inserted underneath the outer protection of most software diskettes. This is the shrink-wrap license to which the purchaser is assumed to agree upon opening the package. Most such licenses stipulate that the buyer cannot "use, copy, modify, merge, translate, or transfer" the software "except as expressly provided in this agreement."

The shrink-wrap license treats software as a trade secret. This poses an immediate practical problem. To consider a computer program used by millions of people as a trade secret offends common sense—the fact that so much copying takes place indicates how few users take the agreement seriously. What's more, at least one court has held such licenses legally invalid.

In 1980, Congress amended the 1976 Copyright Act to explictly include software, partly because



there seemed no other adequate mechanism for protecting what was clearly a valuable asset. Since then, the courts have steadily extended copyright protection for software. At first, it applied only to the source code, written in a programming language such as Fortran or Cobol. Later court cases established that a program's object code, the sequence of 0s and 1s read directly by the computer, was covered as well. In 1986, the flow diagrams that encapsulate the logic and sequence of the program were also included under copyright.

That same year, in *Jaslow* v. *Whelan,* the Third Circuit Court of Appeals affirmed a lower court ruling that copyright protection extends to certain "non-literal" features of the program. The court decided that the screen design and the commands of the program represented the time and effort the computer software programmer had expended in understanding the needs of the application in question—an inventory system for dental laboratories. The conclusion was that such laborious intellectual analysis should be protected. This has set the stage for the "look and feel" cases currently under consideration.

At the same time that copyright protection is being expanded, software firms are again turning to patent protection. Court cases have redefined the status of computer programs under patent law, considering operating systems just like other industrial processes and therefore eligible for patents. In 1986, the artificial intelligence firm Teknowledge received patents on two new software products.

Ad hoc measures could provide too much protection—even to the point of threatening innovation itself.

The Dangers of Ad Hoc Protection

There are a number of dangers inherent in this ad hoc approach. First, it is contradictory to claim that a computer program is a trade secret and yet deserves copyright protection, which assumes broad public dissemination. And saying that the same software can come under both copyright and patent law similarly defies people's sense of what belongs in what category.

Second, ad hoc measures run the risk of shifting the emphasis toward too much protection, even to the point of threatening innovation itself. Protecting the "look and feel" of a computer program could become a serious obstacle to standardizing software applications and could prove extremely costly as well.

For example, should the federal district court in Boston decide that the look and feel of Lotus 1-2-3 can be copyrighted, then every maker of computerized spreadsheets will have to create distinctively different screen designs. This could mean that the techniques and skills acquired by using Lotus spreadsheets wouldn't be transferable to other spreadsheet programs. Individuals and firms would face increased training costs, and even the most innovative software would encounter substantial barriers to entering the spreadsheet market.

Third, as communications technology becomes more complex, the ad hoc approach will become even more cumbersome. For instance, a single "read-only" compact disc (CD ROM) can store a 20-volume encyclopedia. What uses of the CD ROM are permissible within the limits of current law? Can users print the entire 20 volumes, or is this a violation of copyright? If so, how much of the encyclopedia can they reprint? Can portions of the encyclopedia be transferred to another computer, or does this constitute making a copy? Can portions be displayed in the classroom, or might this legally qualify as a performance or retransmission? May the contents be simultaneously networked to many locations, such as different classrooms at a university?

Some lawyers argue that since different mechanisms protect different rights, the proliferation of mechanisms covering the same intellectual asset is both effective and reasonable. So, for example, design of the laser videodisc may be patented; the process by which it is manufactured may be a trade secret; the content of a specific disc can be copyrighted; the commercial name under which the product is marketed will be a trademark; the talent whose performance is captured on the disc will be subject to performance rights; and the work, if retransmitted by a cable system, may be subject to royalties.

The problem is that such an elaborate system is costly and, when it comes to competing in the world economy, a distinct disadvantage. The price of a product must reflect not only the high costs of research and development but also the legal fees necessary to document legal protections and enforce them.

Toward a New Rationale of Protection

As long as the United States depends on the private sector to create and disseminate information, we need a simpler, less costly system for protecting intellectual property. Such a system should recognize that effective protection of intellectual property is not just a legal matter. It is also a function of public attitudes and opinions. No law, no matter how carefully worded, can prohibit widespread practices that the public considers acceptable.

While ethical standards for using new information technologies are still in an early state of development, it seems clear that the public favors flexibility—as long as the original owner of the copied product enjoys no commercial advantage. The rationale seems to be that if you can loan your friends books, why not let them copy your software programs and musical tapes?

A public opinion poll conducted by the congressional Office of Technology Assessment found that 70 percent of those questioned thought copying a record, tape, software, or TV program in one's personal possession is permissible. About half agreed that such copies should be publicly available, for example in a library. However, some 80 percent opposed circumventing commercial offerings such as pay TV or cable television. And nearly all deplored the reselling of databases for personal gain.

Both Congress and the courts have begun to take these attitudes into account. Under the Cable Communications Act of 1984, satellite-dish owners do not have to pay to capture the broadcast signals of copyrighted programs, as long as those programs are not available to them on cable television.

And in the now-famous "Betamax" case (*Sony Corp.* v. *Universal City Studios*), the Supreme Court

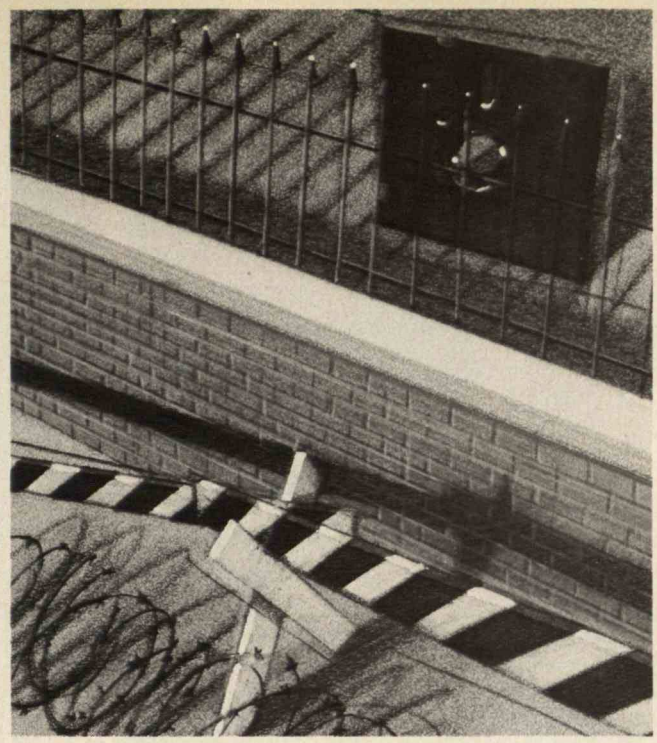
recognized that it would be fruitless to try to turn the tide against the massive purchase of videocassette recorders able to record television programs for later use. Although collecting copied programs for a personal video library might violate the Copyright Act, the Court made a distinction between commercial exploitation and copying for "private use."

Owners of intellectual property are beginning to realize that they must cultivate public awareness and sympathy to protect capital investment. Numerous trade organizations are selecting this route and allocating more dollars to public education than litigation. For example, the Association of Data Processing Service Organizations has initiated a "Thou Shalt Not Dupe" campaign to discourage corporations from copying programs. The association has sent out hundreds of thousands of brochures urging companies to adopt a sample policy statement against copying. Similarly, the recently formed American Copyright Council is launching an advertisement campaign on the legalities of copyright infringement. And in addition to prosecuting flagrant cases of cable piracy, the cable television industry is spending millions of dollars advertising the impropriety of tapping into cable lines.

However, initiatives like these do not address systematic commercial pirating or complicated conflicts between innovation and imitation such as the look-and-feel lawsuits. Here, we need to articulate a new rationale for legal protection.

The starting point should be an understanding that information technology makes the form a product takes easy to separate from the intellectual assets that go into it. This suggests that copyright law, with its focus on the expression of an idea rather than on the idea itself, is inappropriate for protecting what is really valuable in the new kinds of intellectual property.

More suitable would be a system that emphasized the actual use of intellectual assets. For example, the entertainment industry has developed its own legally binding arrangements to determine who benefits from the use of entertainment programs. Standard contracts govern the division of earnings among all those necessary to produce works for continued use on radio, television, and videotapes. Perhaps the software industry could develop similar mechanisms.



Another possibility is a modified form of patent rights with registration procedures, monopoly time limits, and rules for licensing all shaped to the unique realities of the computer industry.

Of course, such efforts may eventually demonstrate that simple and effective protection of new kinds of intellectual property is largely impossible. If so, policymakers will have to reevaluate recent trends toward the privatization of information. When the private creators of intellectual assets cannot be adequately protected for their efforts, then new kinds of public support may be necessary.

Whatever the specific mechanisms for addressing the problems of intellectual property protection, those who are creating the new information and communications technologies—and who best understand their capabilities and limits—need to play a more active role in policy debates. Too often, the lawyers and legislators who write and litigate intellectual property laws have only a superficial understanding of the technology in question.

One possibility would be to create teams of technical experts to serve as negotiators or mediators in complex technological controversies. Or professional associations could develop codes of ethics for what constitutes acceptable—and unacceptable—borrowing of others' intellectual work.

Only when we hear from technologists will we begin to meet the real challenge of intellectual property rights: encouraging creativity while preventing exploitation inimical to investment and the rational allocation of R&D funds. □



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"My name is Pusko Jezic. And, in my youth, I dreamed of bringing home a medal to my country. The dream came true, both in Helsinki in 1952 and in Melbourne in 1956.

"Today, I'm an American citizen, holding a doctoral degree in organic technology. And I'm part of another team...at Dow. We responded to a plea from surgeons for new, lint-free fabrics. Why? Because the lint that's always present in cotton is, all too often, a cause of post-operative infection. Today, non-woven fabrics made from Aspun* resins are making surgery safer.

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Photos from Space

Why Restrictions Won't Work

BY PETER D. ZIMMERMAN

THE security forces of the superpowers had a monopoly on high-quality imagery from space for nearly three decades. Now companies operating from the United States, France, and the Soviet Union provide satellite images to anybody willing to pay for them. The media have used these pictures—specifically those provided by the European SPOT and American LANDSAT satellites—to depict Persian Gulf hotspots, the Chernobyl disaster, and the Soviet missile-

The U.S. government has opened the door to censorship of civilian uses of satellite photos. The actions are bound to fail.



The public is most familiar with low-resolution satellite images such as this one showing the U.S. East Coast and Atlantic Ocean. The red-brown hue near the coastline indicates rich fishing grounds.

warning radar near Krasnoyarsk.

As the media become more familiar with the capabilities of remote-sensing satellites, we can expect more use of images from space. Soon news stories dealing with environmental issues, human migration, geoscience, natural disasters, and military maneuvers could be routinely illustrated with pictures produced by satellite. The U.S. press itself is keenly interested in constructing and operating dedicated media satellites, or "mediasats," to take photographs from space. (It is easiest to think of the pictures as photographs, although technically they are not, because they are produced by electronic sensors.)

But the same satellite data that provide information for the evening news or morning paper are the raw material of military intelligence. The U.S. government is therefore trying to restrict the uses of satellite photography. In 1978 President Carter reportedly signed secret guidelines restricting civilian satellites to a resolution of 10 meters. (In other words, the smallest area that can be deciphered from the images produced by these satellites is 10 meters on a side.) This restriction was removed in January 1988 after the Reagan administration recognized that the rule put American satellite operators at a disadvantage. Nevertheless, the administration has authorized the secretaries of state and defense to impose licensing restrictions on data from American-owned and -operated satellites. These regulations are vague: they do not spell out the restrictions that could be required, but simply cite the importance of protecting "national security" and foreign policy.

This authority is a futile continuation of the government's other recent efforts to restrict press use of satellite photos. Journalists cannot collect, interpret, and present information from these images quickly enough to endanger military intelligence. Moreover, the restrictions are unworkable because a technology that cannot be controlled by a single government is impossible to contain.

Building civilian satellites could be a substantial American high-technology industry. But government censorship of pictures taken from space may well chill or delay the development of high-resolution American satellites. Mark Brender, national-security editor for ABC News, says that while the removal

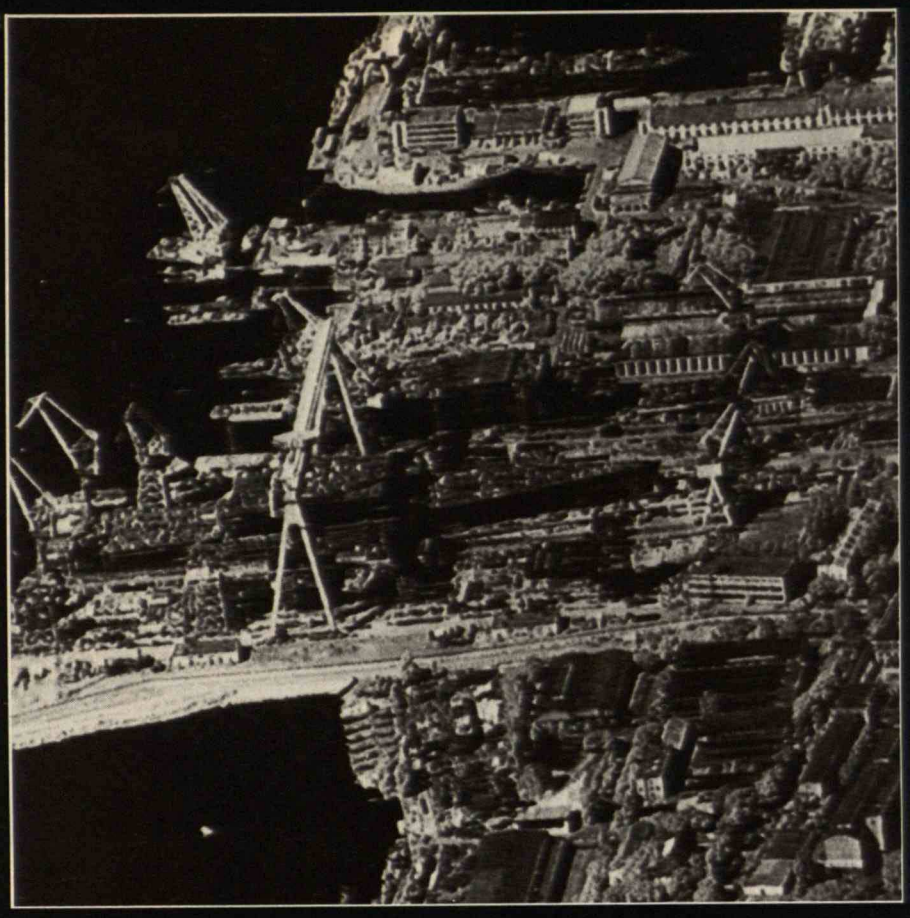




PETER D. ZIMMERMAN, a nuclear physicist, is a senior associate of the Carnegie Endowment for International Peace in Washington, D.C. He co-directs that organization's project on the security implications of civilian remote-sensing satellites, and he contributed to a study of the subject by the Office of Technology Assessment.



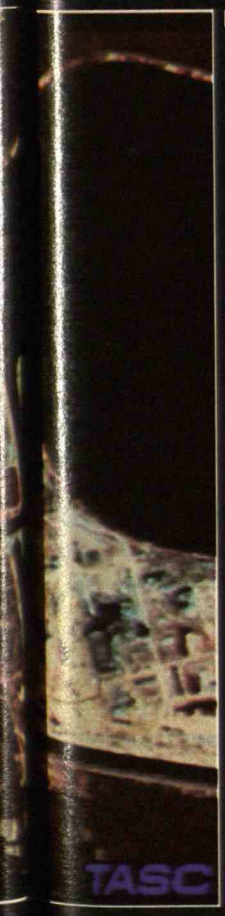
C



The ability of remote-sensing satellites to take pictures of small areas is improving rapidly. The red in this LANDSAT picture (A) of Chernobyl, with 30-meter resolution, indicates warmth. The uniform reddish color of the cooling pond, compared with the river above, shows there was no circulation in the pond, indicating trouble. A SPOT picture (B) of the scene, with 10-meter resolution, gives more detail. A funnel-shaped black area near the center indicates charred ground. The burned reactor is in the black band to the right of the charred ground.

This image (C), taken by military satellite, shows construction of the first Soviet nuclear-powered aircraft carrier. Even girders of small cranes can be seen.

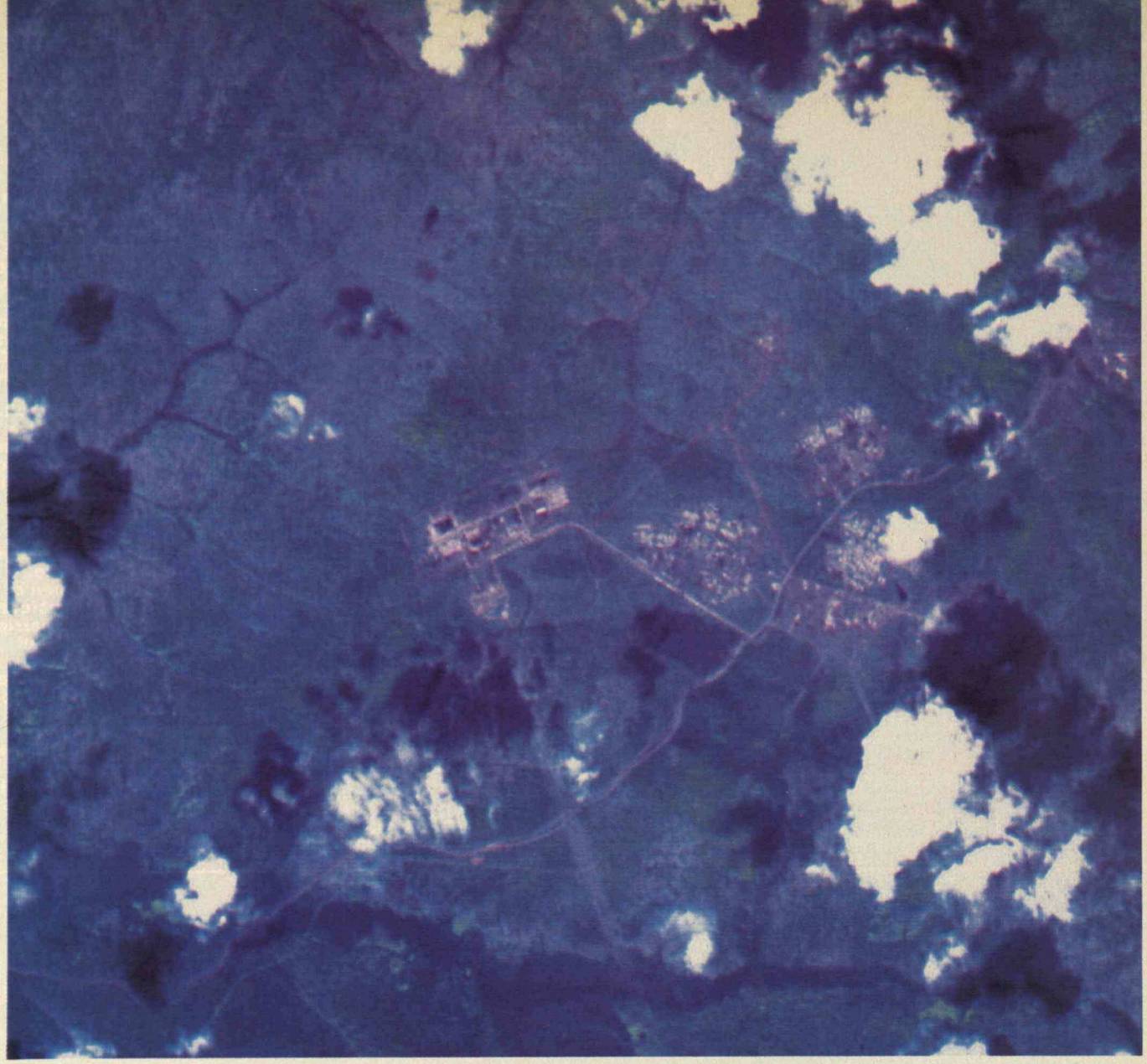
From this Soviet satellite photo (D) of the Columbia River delta, experts can make out details of ships at dock and spot airplanes on the runway (lower left). Resolution is roughly six meters.



D



PHOTOS: EOSAT, INC.; SPOT, INC.; AP/WIDE WORLD; V-O SOYUZKARTA



of the 10-meter resolution is "a clear first step toward the realization of a true 'open-skies' capability for American journalists," it sounds "more significant than it really is." The U.S. government should not hinder a business poised to grow rapidly.

Swirling Clouds, Soviet Ships

The debate over media use of space-based imagery results from improvements in the resolving power of satellite cameras. The technology has developed for three kinds of use.

Most familiar are weather satellites, which offer a resolution of one kilometer or less. The instruments on board take pictures of clouds, covering areas nearly the size of a continent at a single shot.

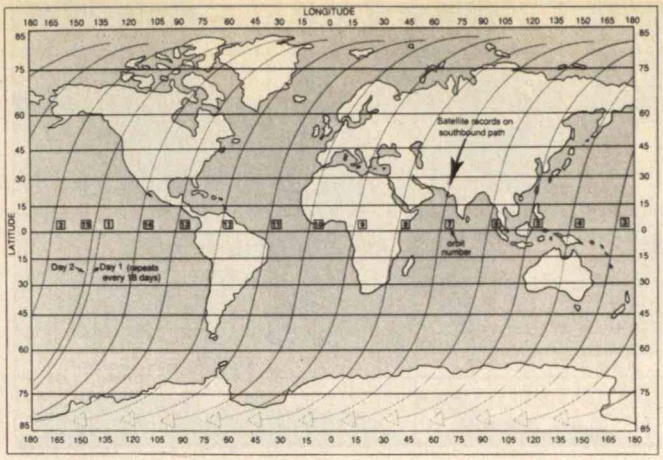
Instruments such as LANDSAT, which has a finer resolution and is used to detect resources such as stands of trees in forests, are the second major kind of remote-sensing satellite. The first LANDSATs could focus on an area 80 meters on a side. The smallest area that a satellite can resolve is known as a "pixel" for "picture element." The current generation of LANDSATs resolve pixels of 30 meters by 30 meters, about the size of a baseball infield. Such resolution is good enough to detect extremely large buildings and some details of airfields and harbors, in pictures measuring about 140 kilometers on a side.

SPOT, the Japanese MOS-1 used to study the ocean, and some Soviet satellites also can resolve images as small as tens of meters on a side. China, India, Brazil, Canada, and West Germany are interested in launching instruments with this quality.

Some of these satellites can measure infrared radiation. LANDSAT and certain satellites operated by the Soviet Union can detect the long-wavelength radiation produced by heat sources, such as the cooling ponds of nuclear reactors. LANDSAT pictures of the Chernobyl disaster indicated the number of reactors still operating in the complex by showing the level

PHOTO: SPACE MEDIA NETWORK

Satellite images probably could not be distributed through the press quickly enough to reveal sensitive information. LEFT: Experts took three months to find the Krasnoyarsk radar (center) in a satellite picture. White patches of clouds surround the installation. RIGHT: The first LANDSATs needed 18 days to photograph the entire Earth. Each of today's two LANDSATs need 16 days, 8 if used in concert.



of heat they generated. And both LANDSAT and SPOT can see short-wavelength infrared radiation, which is produced by very hot sources such as the sun. This allows the instruments to produce high-contrast pictures because short-wavelength infrared light penetrates the earth's atmosphere with less scattering than regular light. This kind of infrared sensing can indicate the difference between foliage and military equipment camouflaged by green paint, because plants and inanimate objects reflect the energy in sunlight differently.

The third kind of remote-sensing satellites—those that apparently can show details far smaller than one meter—are used for military reconnaissance. Information about these instruments is secret, but military-satellite photos of a Soviet shipyard clearly reveal the mullions on factory windows and girders in a crane. (Samuel L. Morrison, who supplied these images to the British journal *Jane's Defense Weekly* while working for the U.S. Naval Intelligence Support Center, was later convicted of revealing classified information.)

The line between military and civilian remote-sensing satellites blurred in February 1986 when the SPOT satellite, operated by a quasi-public corporation owned by the French, Swedish, and Belgian governments, entered service. SPOT's resolution is 10 meters in black and white and 20 meters in "color" (it actually reproduces only certain visual colors but picks up short-wavelength infrared), and its pictures cover 60 kilometers on a side. ABC News, the Swedish news service Space Media Network, and many newspapers and magazines have used SPOT's cameras to focus on militarily important targets such as the Iran-Iraq border region, Soviet laser installations, and the Pakistani nuclear facility at Pinstech. SPOT can reveal the general type and mission of ships, large airplanes, and other military equipment, as well as distinguish aircraft from other objects on the Earth's surface.

Last July the Soviet Union put satellite photographs of still better resolution—roughly 6 meters—on the market. They have been produced by a Cosmos satellite that can focus on short-wavelength infrared or visible light. The Soviet trade delegation to the United States has given me photographs of the Columbia River delta that it says have been taken with the satellite's high-resolution "KFA-1000" camera. The photographs show ships' details equal to or better than the best obtainable from the SPOT black-and-white camera.

Now Sweden is considering launching a satellite offering one-meter resolution, primarily for use in verifying arms-control treaties. In the United States, the recently formed MediaSat International Corp., for which I consult, is exploring whether to develop satellites dedicated to the news industry that could probably show objects as small as three to five meters wide. EOSAT, the company operating LANDSAT, is also polling media representatives to determine their interest in a satellite that would provide three-color, five-meter images and daily coverage of the globe.

So far remote-sensing satellites have typically cost $300 million. But a properly designed mediasat with five-meter resolution could probably be built and launched in a four-year period for less than $10 million, using modified off-the-shelf equipment. This is hardly excessive for news organizations that spend $300 million to cover the Olympics.

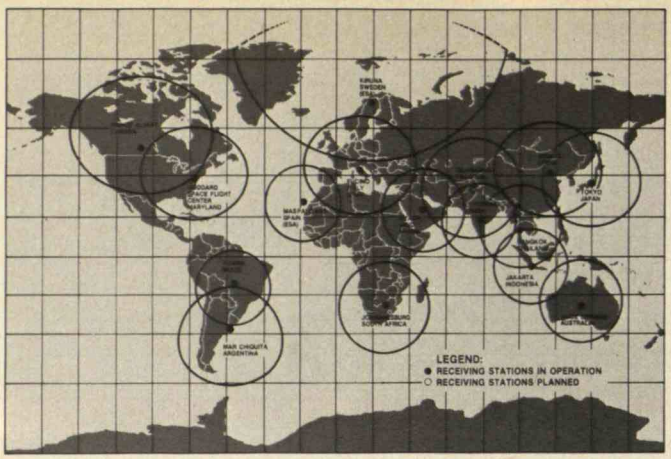
How Timely?

The ability to gather news from space raises the question of whether, in a military crisis, the press would reveal information that could jeopardize American lives or obstruct U.S. foreign policy. Some CIA and State Department officials fear that the United States could lose the diplomatic clout it now wields when it secretly offers information to allies and clients.

It is unlikely that the media will discover information timely enough to be considered "intelligence." Obtaining images from space is not easy. A satellite can take a picture only when both weather and daylight cooperate, and of course the satellite must be in the proper location over Earth.

Today's SPOT and LANDSAT systems may be in the

CHART: *MAN ON EARTH*, MACMILLAN



The government would find it impractical to require companies to destroy satellite images before selling them, as suitable ground station sites exist in more than one country. The chart shows the ground stations available to today's LANDSATs.

correct position only once or twice a week. A well-designed mediasat could cut the average time for delivery of a picture, but only to 12 hours at best. Physical laws set lower limits on the delivery time: satellites cannot orbit the Earth faster than once every 90 minutes since drag would otherwise draw them inside the atmosphere. And a camera orbiting at the lowest possible altitude can photograph only a limited swath of the Earth during each revolution. Hence, the best satellite would require a full day to photograph the entire Earth. So chances would be equal that at the time of a request, a satellite would have just passed over a particular location or would just be approaching it. Thus the average time for acquiring a picture would be half a day.

To appreciate the minimal effect of remote-sensing imagery carried by the press during a fast-breaking situation, consider a recent Mideast incident. On August 8, 1987, a convoy of U.S.-flagged Kuwaiti oil tankers escorted by American warships secretly entered the Straits of Hormuz. Attempts by the U.S. government to restrain coverage by a news-gathering satellite would have been irrelevant. A satellite probably would not have been in position to observe the vessels' initial movements—which presumably alerted the Iranian Navy via its picket ships, radar, or mainland observation sites. The media could not have relayed the information to the public as quickly as those instruments.

What about the need for a government to keep some information, such as the buildup of a U.S. fleet off the shore of Libya, secret for an extended period of time? Mediasats would be unlikely to affect such a situation because intelligence satellites operated by other countries would probably discover the operations first. Intelligence services have the resources to know where to aim their cameras and are better able to process and analyze their pictures.

Indeed, the timing problem is exacerbated by the fact that it is difficult to find specific sites on a photograph once it is available. It is equally difficult to spot a target that approaches the limits of resolution in a wide-field picture. Strong collateral information has to be available—details that in most cases are themselves good enough to spark a news report. A picture that reveals more intimate details can cover only a limited area.

The history of the SPOT image of the Krasnoyarsk radar—a picture discovered and processed by Space Media Network—illustrates the problems. The radar is not at Krasnoyarsk, but near a village called Strelka. The facility covers about 750,000 square meters, and therefore comprises only 0.02 percent of the SPOT picture. The analyst who found the radar had to scan several images before he could locate it. One picture would have shown the radar—but a patch of clouds hid it. Clouds almost covered the installation in the image that ultimately proved useful. Without the near certainty that a newsworthy facility was located somewhere in the Krasnoyarsk region of the Soviet Union, no news organization would have invested the time—three months—and resources to acquire and study pictures of central Siberia.

Could the media damage international relations by misinterpreting satellite imagery? After the U.S. government hinted to the media that two reactors were probably burning at Chernobyl, both ABC and CBS misinterpreted a LANDSAT image and reported erroneous information. In another incident, a *New York Times* article inaccurately concluded from a satellite picture that the Soviet Union was ready to resume nuclear testing after a self-imposed moratorium. It turned out that the image did not show a new test site, as the *Times* suggested, but a pre-existing site for measuring the effects of a test. These incidents have embarrassed the media, and will undoubtedly motivate news organizations to find experts who can interpret images reliably.

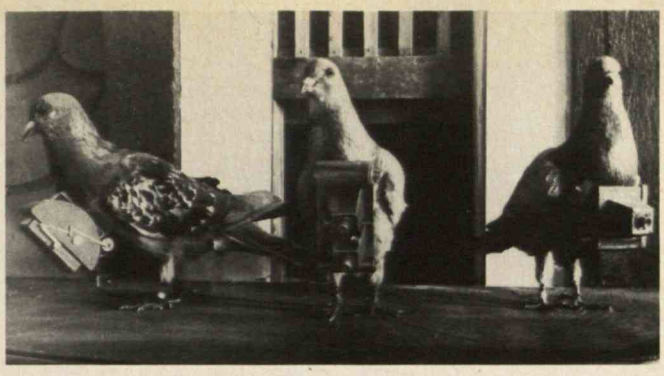
And what about reporters who receive leaks about precise locations and descriptions of sites, helping them interpret images faster? The press should not have to be regulated because the government has not staunched leaks from its own employees and contractors.

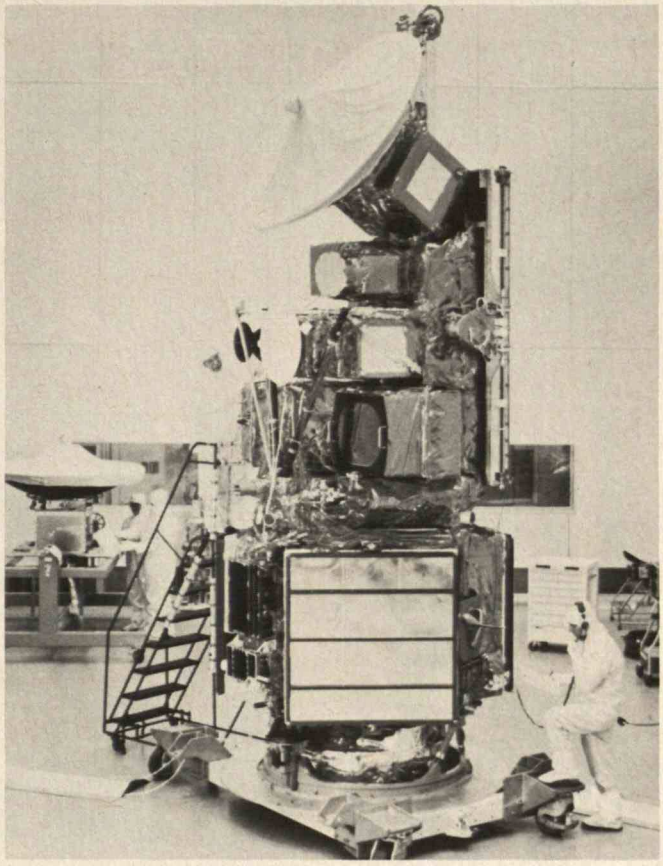
Why Setting Limits Won't Work

The government's interest in restricting the media's use of images from space continues its recent attempts to constrain the press. The U.S. Department of Defense severely curtailed coverage of the U.S. invasion of Grenada. Cameras were not allowed to

CHART: EOSAT, INC.

In 1909 pigeons carried cameras used for aerial surveying. The newest LANDSAT, shown during a pre-launch check in 1984, relies on solar power.





accompany the U.S. troops, and the military kept aircraft chartered by the news media so far from battles that television captured few if any interesting images.

What could the government have done if an American satellite offering images to the media had passed above Grenada? The secretary of defense could have ordered the satellite owner to destroy some or all of the information during transmission to the ground. He could also have set limits in advance on the basic sensing capability of any U.S. satellite.

Since January 1988 the U.S. government has recognized that the latter idea won't work. Fetters on the technology are impractical because no single government could assert control in a situation in which a satellite was owned by a Netherlands Antilles corporation, built in Japan, launched by a Chinese booster, flown under a Panamanian flag of convenience, transmitting its data to Canada, and selling its images to networks on five continents.

Compulsory destruction of images before their sale is also impractical. Satellite images can be halted only if the data are sent to a ground station under control of the censoring government. Suitable sites for ground stations exist in more than one country. The press could locate ground stations on territory not controlled by the censoring government.

What about censoring U.S. satellite pictures altogether? This would be impossible in practically all cases because blanket classification amounts to prior restraint on the freedom of the press. The release of photographs would have to pose a grave, immediate, and irreparable risk to national security for the Congress or president to grant the authority to classify. The only legal exception to this rule—concerning certain information about nuclear weapons—has proved to be a difficult, if not impossible, provision to enforce. And in any case, the U.S. government is powerless to classify a foreign satellite's pictures published overseas.

It is in the national interest to allow the U.S. remote-sensing industry the widest latitude to develop and launch the best possible instruments for all uses. To do otherwise would deprive American industry of incentives to develop better commercial sensors and ways of analyzing data. The vaguely stated requirement that American operators of remote-sensing satellites must further "national security" can only dampen the interest of entrepreneurs who are considering whether to risk their money and time in such a venture.

Total sales from satellite photography by the end of the century could range from hundreds of millions of dollars to $7.4 billion dollars or more, according to KRS Remote Sensing, a Kodak company. The U.S. regulations prompt the question of what fraction of that sum will go to American companies and what fraction to their foreign competition.

In difficult times it would be preferable for the operators of mediasats to be Americans, loyal to and supportive of the country. It is difficult to envision U.S. satellite operators turning down their government during times of need.

In peacetime, an unregulated industry would reflect the ideals of the U.S. Constitution, which protects free competition and reporting. This country would be much better off without restrictions that could censor American remote-sensing activities. □

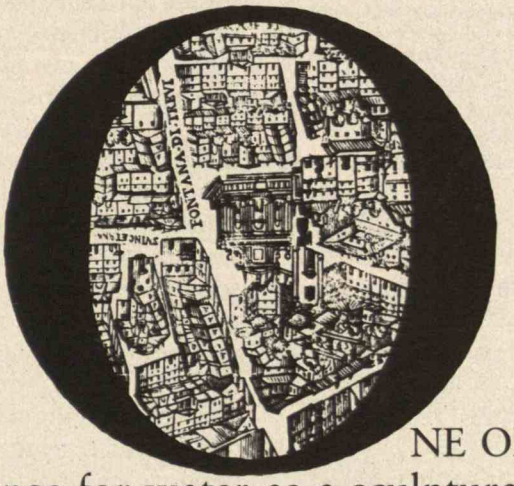
PHOTOS: NOVA; EOSAT, INC.


CLEMENS XII PONT MAX
AQVAM VIRGINEM
COPIA ET SALVBRITATE COMMENDATAM
CVLTV MAGNIFICO ORNAVIT
ANNO DOMINI MDCCXXXV PONTIF VI

Water as an Element in Architecture

IS ANY FOUNTAIN BETTER THAN NO FOUNTAIN AT ALL? ARCHITECTS AND ENGINEERS COULD AVOID BANALITY IF THEY BETTER UNDERSTOOD WATER'S POWERFUL AESTHETIC APPEAL.

BY M. DOLDEN



ONE OF THE MOST opulent settings for water as a sculptural and architectural feature is that of the Trevi fountain, which lies just east of the Tiber near the intersection of two of Rome's busiest shopping streets, the Corso and the Via del Tritone. Designed and completed in 1762 by architect Nicola Salvi, this late-baroque extravaganza is a "treatise on water" (in Salvi's words) that stretches across the entire facade of the Palazzo Poli.

The fountain's central figure is Neptune, who rides in a winged chariot perched on the highest and small-

PHOTO OF TREVI FOUNTAIN BY MIKE MALYSKO/STOCK BOSTON



Crowds gather on the steps facing Rome's Trevi Fountain. The water, which comes from springs in the Alban Hills miles away, explodes into activity in the gargantuan structure. Passers-by experience a dynamic relationship with the scene.

est of three descending basins of increasing size. A series of spectacular wings of stone fan out on either side of the basins. To Neptune's right, a triton representing a stormy sea wrestles a winged horse with a dolphin's tail, while to his left another triton representing what Salvi called "the sea of tranquility" leads a more placid-looking horse over a shelf of rock. To either side of Neptune, in niches in the facade of the palace, stand statues representing health and abundance.

This explosion of activity makes it seem as if some momentous drama were being played out against the huge but sedate facade behind it. "That Neptune should suddenly appear escorted by Tritons and seahorses and accompanied by a great waterfall, upon the placid facade of an Italian palace, [is] a display of . . . energy as violent and unexpected as a burst water main in Picadilly," wrote the historian H.V. Morton in 1966, adding that onlookers descending the steps toward the fountain feel they are taking their places in a theater.

There is no mistaking the purpose or the source of the fountain. It is there to give water, which comes (as a young woman in one bas-relief mutely shows) from the nearby Alban Hills. The water has its own dramatic story. Its source, the Acqua Vergine, was occupied in 19 B.C. by the Roman emperor Agrippa. The Acqua Vergine originates in springs formed by rainwater that must travel a full 24 hours from the Alban Hills through miles of volcanic rock before finally reaching the city.

While the fountain is gargantuan, it never overwhelms the bystander, since there is plenty of room in the piazza to stand off and contemplate the scene. The Trevi is one of history's best examples of the use of water to integrate a structure with its surroundings, and to bring passers-by into a dynamic relationship with the whole scene.

Today water is as ubiquitous in architecture as ever before, technological advances having made it easy or even imperative to install water features in public places. Every upscale retail center has its fountain; pools encircle corporate headquarters, and water walls are installed as natural features within the concrete canyons of major American urban centers. Often the centralized and sophisticated heating, ventilation, and air-conditioning (HVAC) systems of shopping malls and large commercial centers require running water—cooling pools, for some air-conditioning systems—so architects have often used these sources as above-ground architectural features. A pool or fountain connected to an HVAC system in an indoor atrium or mall, for example, can help control temperature and humidity. The energy crises of the 1970s especially spurred architects to employ this method of cutting the costs of regulating the temperature of large, open spaces.

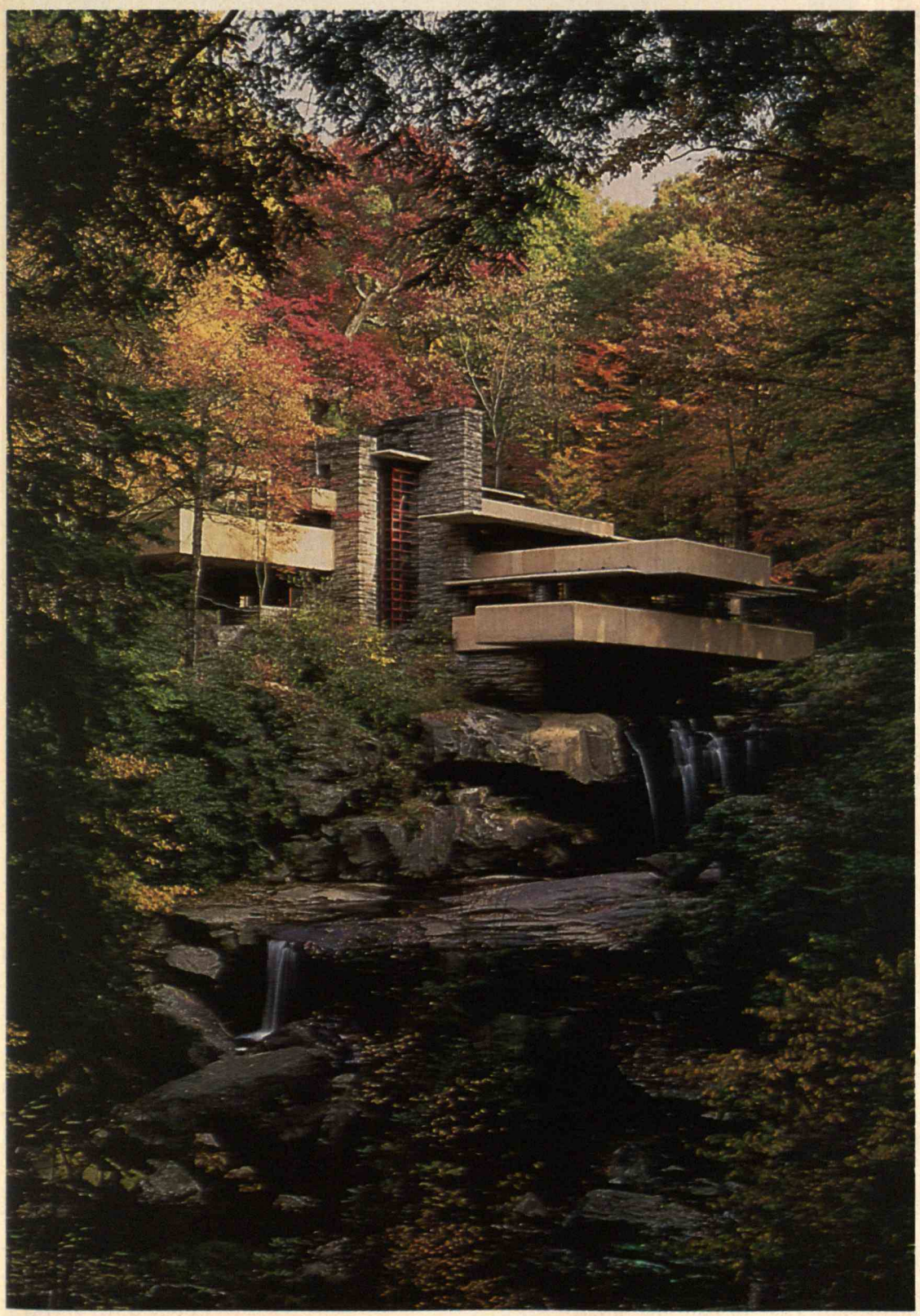
Because water has such elemental appeal—aesthetic, psychological, and physiological—many contemporary developers and architects think that with a fountain you can't go wrong, regardless of where and how it's built. Water installations, easy and convenient as they are to plan, seem to multiply around us with little regard for their purpose. Often the banality of contemporary water design stems from a failure to integrate the powerful, symbolic nature of water within the physical setting, or to make use of the beauty of water in motion or as a mirror for its surroundings when at rest.

A House Over Water

No contemporary fountain packs the wallop of the Trevi. Even the most sensitive and inspired designs of twentieth-century architectural giants like Louis Kahn or Frank Lloyd Wright can't equal its impact

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THE ENERGY CRISES OF THE 1970s SPURRED ARCHITECTS TO USE FOUNTAINS TO REGULATE TEMPERATURE IN LARGE OPEN SPACES.



Fallingwater, a house in Bear Run, Pa., designed by Frank Lloyd Wright, is integrated into its surroundings, which include a stream and waterfall. On a small scale Fallingwater is as much a celebration of water as the Trevi. The terraces descend much like the waterfall along the slope below.

PHOTOS: PETER MENZEL/STOCK BOSTON; CHRISTOPHER LITTLE

on our historical consciousness. But some works do fulfill the same integrative task Salvi undertook.

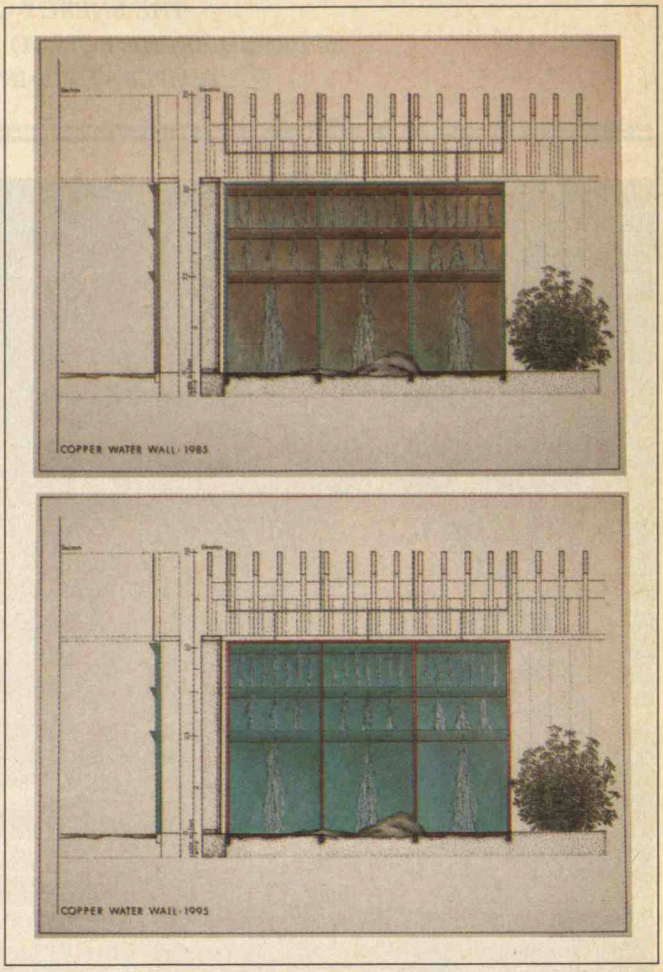
Fallingwater, a 1936 house designed by Frank Lloyd Wright in Bear Run, Pa., represents one of the most successful twentieth-century uses of water as a landscape design element. Surrounded by trees, the house is built on several levels down a rocky slope and over a stream that descends precipitously in a waterfall. Views of Fallingwater from the side and below show a series of cantilevered terraces that overhang the stream and waterfall. To enter the house one crosses by way of a bridge from a rocky abutment to the top story. In a 1986 fiftieth birthday celebration of the house Kathryn Smith, a professor at the Southern California Institute of Architecture, said the bridge gave the feeling of a "ceremonial entrance" that established the difference "between the . . . magical realm of the building and its site and the outside world."

On a small scale Fallingwater is as much a "celebration" of water as the Trevi. Inside the house the water can be heard as it plunges into the fall below. Stepping out onto the terraces one sees the stream and waterfall. The house, moreover, is as integrated into its surroundings as the Trevi. The terraces look as if they mimic those elements, jutting out from the house much as the boulders flanking the house do from the hillside, and descending down the side of the house as the waterfall does along the slope below.

To achieve their effects Salvi and Wright worked from very different esthetic premises. The aim of the baroque artist was to assert control over nature. Sculpture is carved to look like natural rock; the water's terrific force is disciplined to enhance the sculpture. Wright, by contrast, didn't try to bend the Pennsylvania stream to the demands of his work, but rather made the house fit as naturally as possible over the water and into the surrounding hillside, trees, and boulders.

Water as Art

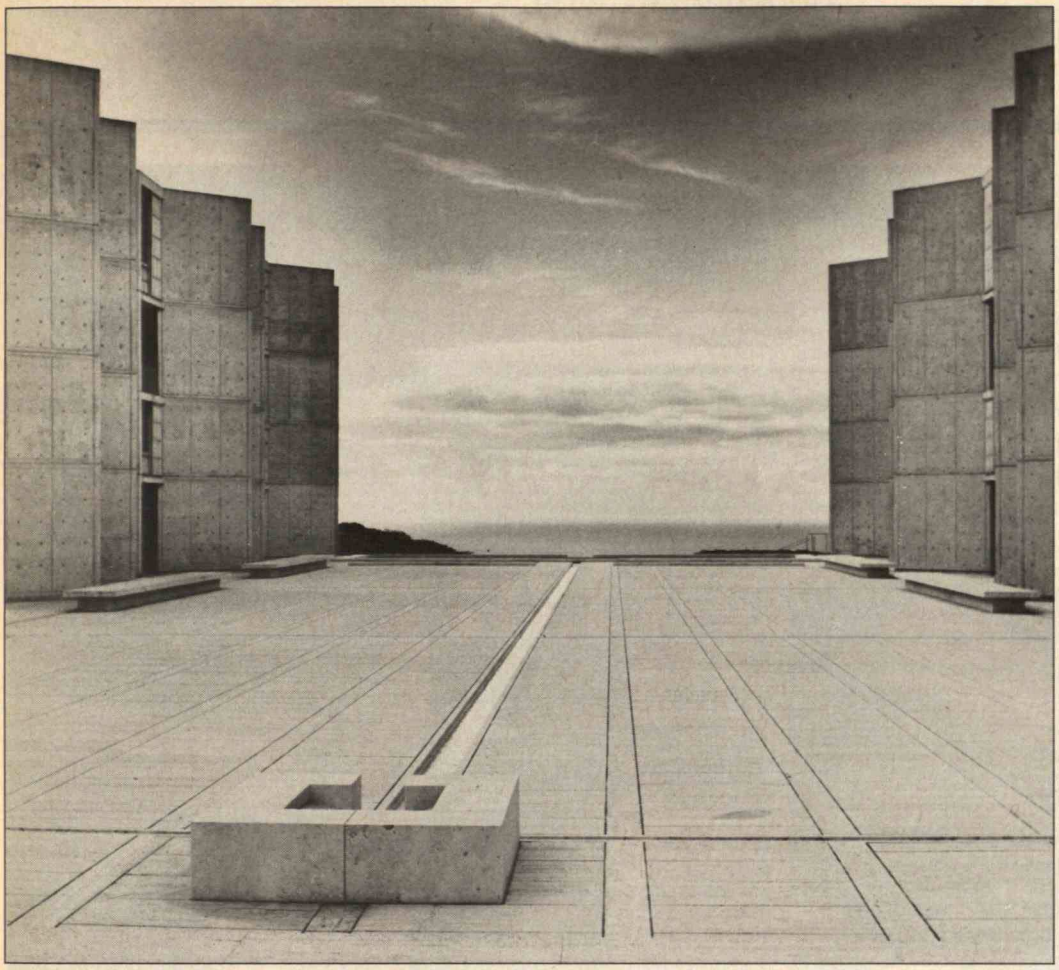
On a far more intimate scale than Fallingwater, the Isaacs Water Wall uses water to integrate a Boston carriage house with an adjacent courtyard. The Water Wall, designed by landscape architect Michael Van Valkenburg, stands at one end of the small courtyard and is composed of three wood-framed horizontal copper panels of equal size. The panels are bathed by water that trickles down by way of a



series of perforated troughs. Rainwater collects in an initial, upper trough to flow through 14 holes down the face of the first panel. It then collects in a second trough, but since this one has only 6 holes, the water's points of passage down the second panel are more widely separated than they were down the first. The third and final trough contains only 2 holes.

The oxygen in the water produces verdigris, a green and bluish mottling of the metal, so that the water leaves a visual record of its passing in designs determined by the spacing of the holes. The wood that frames the panels is painted Chinese red to enhance what is as much a dynamic painting as it is a fountain.

One looks at this creation from behind French doors that open onto the courtyard. Two brick strips extend from the house down the courtyard and to the wall. Moss grows between the lines of brick, and from the house the three elements appear as a triptych that repeats the wall's three sections. At the very end of the path a large boulder makes a sort of punctuation mark underneath the "painting" itself. The courtyard is enclosed by the house on one side, with high white walls on the other side and back.





FAR LEFT: Michael Van Valkenburg drew two sketches showing how his Isaacs Water Wall, in the courtyard of a Boston residence, will change over time as the trickling water affects the color of three copper panels. LEFT: For the Salk Institute in La Jolla, Calif., Louis Kahn created a sense of solitude by designing a trough that carries water across a courtyard toward the horizon of the Pacific Ocean. BOTTOM: The pool in the Ford Foundation Building in New York provides an oasis within the bustle of the surrounding urban landscape.

Thus the courtyard becomes a gallery for the abstract artwork of the wall. The unusual use of water within this setting integrates the landscape as harmoniously as pools, trees, and shrubs do in more conventional garden and courtyard landscaping.

A Cloister for Science

Louis Kahn, an architect based at Yale through the 1970s, used water on a far larger, public scale to integrate the stark laboratory buildings with the courtyard of California's Salk Institute in La Jolla. Two sets of white cement research and office buildings face each other across a huge white courtyard. A narrow trough or "line" of moving water bisects the courtyard perpendicularly, then forms a T with a horizontal trough that cuts across the opposite end of the courtyard. This second, horizontal trough channels the water so that it spills abruptly down a wall in two arcs or "wings," as they are often described. The running water makes its way toward the western horizon through quiet pools and gentle cascades that bisect the length of the courtyard until it drops from sight.

Jonas Salk initially approached Kahn with the idea of a sort of cloistered garden. While Kahn's design doesn't immediately appear cloistered, it still manages to create a sense of solitude and contemplation. He opened the architecture up rather than enclosing it, but the stark whiteness of courtyard and buildings as well as the quiet lines of water moving through them give a monastic impression. Water is a unifying element in this austerity, its long lines connecting the buildings. And since the Institute perches on top of a cliff that descends to the Pacific, the movement of the water in its troughs draws the viewer's gaze from the buildings through the courtyard to the horizon of sky and ocean below.

Parks within Skyscrapers

The Ford Foundation Building, which stands in the heart of Manhattan between 42nd and 43rd streets at the East River, is at an opposite pole from the large, open spaces and planes of the Salk Institute. Yet here architect Richard Kiley developed a modern oasis separate from the surrounding urban landscape, an interior park that spans half a city block.

PHOTOS: MICHAEL VAN VALKENBURG; SALK INSTITUTE; EZRA STOLLER/ESTO

BELOW: The pool at the center of the L.L. Bean store in Freeport, Maine, contains trout and is surrounded by rocks. However, it is difficult to sit by the pool, look over its ledge, and relax. RIGHT: Conspicuous consumption of luxurious materials prevails in this fountain at Boston's Copley Place. The water isn't used imaginatively to explore stone or sculpture.





PHOTOS: SYMMES, MAINI & McKEE; STEVE ROSENTHAL/THE ARCHITECTS COLLABORATIVE

FOUNTAINS AND POOLS CAN INSPIRE WONDER WITHOUT BEING COSTLY OR GRANDLY PRESENTED.

The building's core is hollow. Terraces on each floor look down to the park below.

Since the Ford is on two levels the park is on split levels, too. After entering the park through the Ford's 43rd Street doors, one moves down through it by way of steps and paths, surrounded on all sides by densely planted 30-foot trees, groundcover, climbing ivy, and shrubs. Upon reaching the 42nd Street side one looks outside through a glass wall. Just within is a 15-foot-square sunken basin, invisible from the park's entrance. But it becomes a focal point as one moves toward it, a punctuation mark defining the central axis of the plan. Benches of the same stone as the park's terracing surround the pool, so one can sit there quietly for a moment, looking out at the bustle of 42nd Street.

The whole effect is of a lush, peaceful place for reflection. The pool is different from the imposing Trevi waters or the natural setting of Fallingwater not only because it is indoors, but because it makes such a quiet statement about its surroundings, defining the difference between the interior park and the teeming city outside. It performs its integrative function by being at the lowest, most inconspicuous spot in the park, providing an understated tranquility within the surrounding lushness.

Missed Opportunities

For every example of such harmony there are countless others at odds with their surroundings and the hapless bystander. Take the 30-foot semi-circular pool under the central stairway of the L.L. Bean camping-goods store in Freeport, Maine. On mounting the stairs to the second floor, one can gaze down at the water, which contains trout—a charming touch, since trout populate Maine's waters. It would be nice for shoppers to be able to sit with their rambunctious children and look at the fish after buying their outdoor clothes and camping equipment. But the natural instinct to perch on the boulders that surround the pool is abruptly thwarted by signs explicitly saying not to do so. The few wooden benches that have been provided are so low as to make it impossible to see over the pool's rocky ledge. Thus the pool is at odds with what we would expect to do in such a spot—sit around it, look at the fish, and relax. The water becomes an awkward gimmick, little more than a holding-pen for the trout.

A more significant missed opportunity is the use of water near the center of Boston's Copley Place—a large, enclosed arcade that connects an office tower, a movie complex, and two of the city's poshest hotels. The mall's interior is finished largely in marble in shades of rose and gray. An enormous fountain consists of water that cascades from a height of four stories down planes of polished granite and marble. The water empties into an irregularly shaped pool. A second pool that is bordering a broad swath of paving is visually separated from the fountain.

Designers of contemporary spaces often ask us to look beyond the normal range of vision, but from most perspectives it is difficult to take in the scale of the fountain and pools together. Moreover, there is nothing here that makes a person think. People are always curious about water, so the fountain does draw attention, but the water isn't used imaginatively to explore stone or sculpture. The colors of the fountain echo the colors in the rest of the mall, but this only extends the conspicuous consumption of luxurious materials.

Imagination on a Small Scale

To inspire wonder and stir the imagination, water in architecture and landscape design doesn't have to be costly or grandly presented. The urban designer and landscape architect Lawrence Halprin has observed that within any community we can expect to get a few great things and then "a good average series of things." According to Halprin, maintaining an average of high-caliber work may be more important than encouraging occasional instances of great or monumental work. What counts is what he calls "average wonderfulness," modest but successful work at low cost.

As an example of modesty that stirs the imagination, take Harvard University's Tanner Fountain, a stone, mist, and steam garden in the middle of the campus. Working with environmental sculptor Joan Brigham, landscape architect and designer Peter Walker took advantage of the ephemeral qualities of water to enhance and make suggestive what had been a less-than-extraordinary site. Positioned between the abstractly modern Science Building and a venerable Victorian eccentricity, Memorial Hall, the fountain is a simple collection of 159 New England

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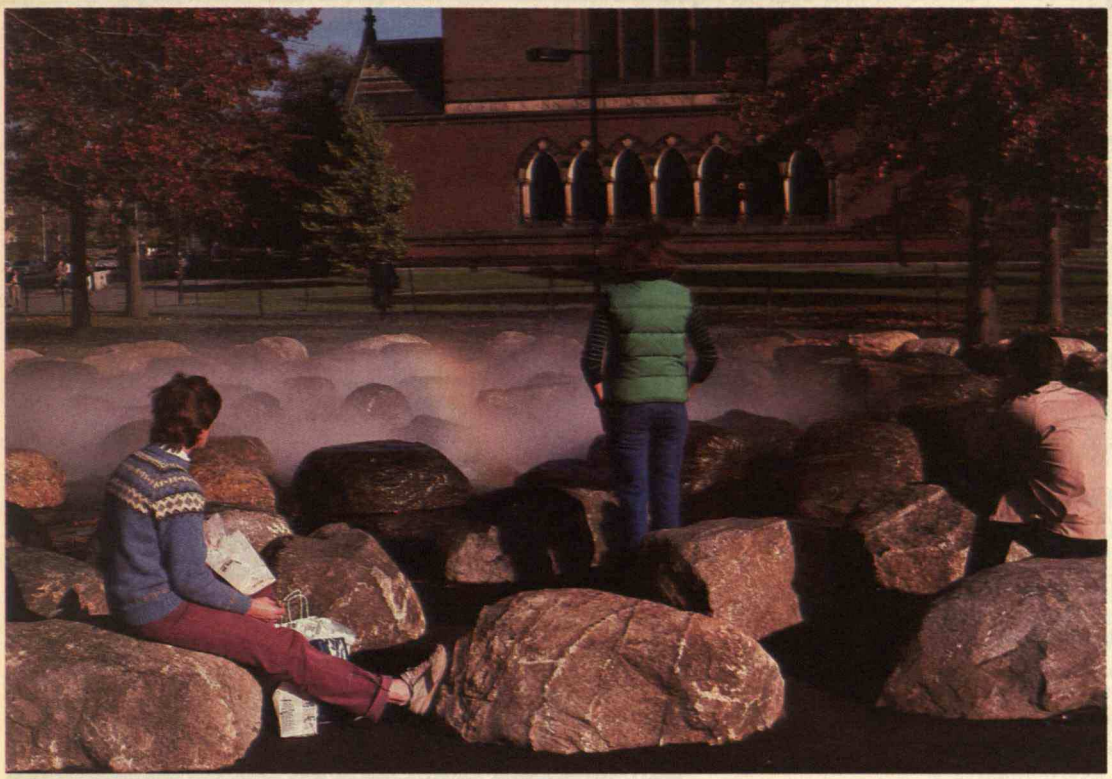
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APPRECIATING WATER IS DIFFERENT FROM UNDERSTANDING BRICKS AND MORTAR, HYRAULICS AND INTERIOR SPACES.



People gaze at the mist that rises above concentric circles of fieldstones at Harvard University's Tanner Fountain. The project's simplicity contrasts with Memorial Hall's Victorian ornateness in the background.

fieldstones placed in five concentric circles and implanted in asphalt. An interior ring of 32 water jets sits within the asphalt bed and produces a sparkling mist, a touch of romance in the staid Harvard setting. Children jump from rock to rock and students make a sudden lunge through the fountain's cooling mists on a hot summer day.

The materials of the Tanner aren't grand; they are deliberately ordinary in their context. Yet they become quite beautiful under the watery mist. And at night, under careful lighting, the mist seems to hover just above the ground with a spectral quality.

Walker had a sense of humor, grace, and simplicity in designing this unusual work. His additional triumph was the imaginative use of the vast resources of the adjacent Science Building's heating and cooling system to fuel the fountain. In winter a steam vent feeds into the fountain from directly beneath it. A separate water source feeds the mists of spring, summer, and fall.

Walker's intentions for the Tanner were never lofty. He wanted to build a fountain that was "vertically transparent," keeping views across Harvard's campus open and providing a place for people to gather and rest. Since the university plans to redesign this campus crossroads, Walker also wanted to keep things flexible enough to allow for alterations to the surrounding area.

At a total of $250,000, the Tanner undoubtedly cost much less than the Copley Place installation, showing that great expense isn't needed to use water sensitively in landscape design and architecture. The designer must simply understand something about the essence of this particular material. Such an appreciation is different from technically understanding bricks and mortar, hydraulics and interior spaces. What is needed is a respect for water as a dynamic element, not simply as a decorative addition.

Such sensitivity would help architects and engineers avoid the anonymity that characterizes so many late twentieth-century commercial schemes. Every office building is identical to the one preceding it. The atrium of every posh hotel is like every other, surrounding a shaft with lighted capsules shinnying their way from sunken pools through ivy-covered terraces to slowly turning restaurants in the sky. Such costly emptiness kills memory, beauty, and dreams, the stuff of wonder. There are humbler but more inspiring alternatives. □

PHOTO: ALAN WARD

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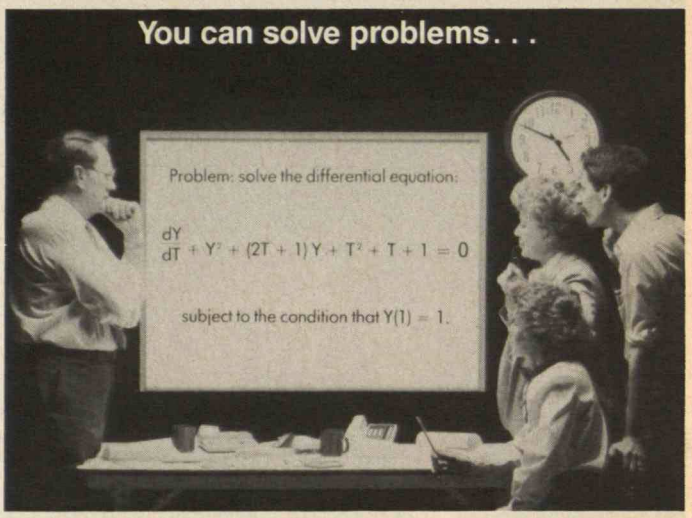
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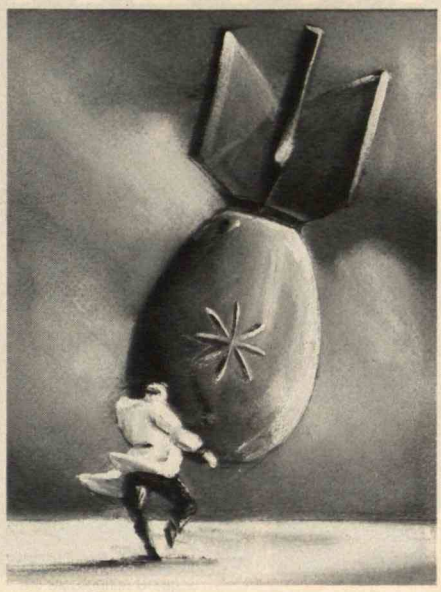
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Scientists and History

Nuclear Paradox

The Making of the Atomic Bomb
By Richard Rhodes
Simon & Schuster, $22.95
Simon & Schuster Touchstone Paperback, $12.95

Reviewed by Michael Riordan



It has been a bloody century so far, by far the bloodiest ever. The aim of modern war has been not merely to defeat an enemy's armies on the battlefield but also to destroy its entire society—agriculture, industry, and population. More than 100 million people have died by human hands since 1900, most of them in the two World Wars. Almost all of these deaths came by what we now call "conventional" means. Only a few hundred thousand people, unfortunate citizens of Hiroshima and Nagasaki, have died by "unconventional" means, as a result of atomic bombs.

Since 1945, however, the *rate* of killing, which had been growing at alarming speed during the previous decade, has tumbled sharply. The overall effect of nuclear weapons, by making total war far too costly, has actually been to suppress the rationalized extermination of one human being by another. This, of course, is a highly provisional state of affairs. Were a nuclear war to break out next year between the United States and the Soviet Union, this century's total of human-caused deaths would likely double overnight. With the drop in the killing rate has come an exponential growth in killing *capacity*.

The great project of our time is to make certain this terrible capacity is never used. If we succeed, then nuclear weapons will have helped confer a major benefit upon humanity: the elimination of total war. Such a bafflingly paradoxical aspect of nuclear weapons, what the Danish physicist Niels Bohr termed their "complementarity," is an important theme in an absorbing, hopeful, and highly acclaimed book, *The Making of the Atomic Bomb* by Richard Rhodes. Winner of both a National Book Award and a Pulitzer Prize, it attempts nothing less than a detailed history of the bomb—its scientific roots in early atomic and nuclear physics, its hurried wartime development by the Manhattan Project, plus its far-reaching political and philosophical implications for our precarious planet.

Bearing Its Own Solution

Rhodes's epic begins early in the 1900s with the discovery of the atomic nucleus by British physicist Ernest Rutherford and its incorporation by Bohr into a model of the atom, with a nucleus at its core and electrons whirling about in fixed orbits. As the century progresses and a more sophisticated quantum theory comes along to supplant Bohr's crude model, physicists begin probing inside the nucleus itself, discovering it built of protons and neutrons. During the early 1930s, Leo Szilard speculates how vast amounts of energy might be obtained by splitting the atom, but Rutherford dies in 1937 insisting that "anyone who looks for a source of power in the transformation of atoms [is] talking moonshine."

Meanwhile science and technology are repeatedly pressed into service by anxious European governments intent on building the most advanced "death machines" imaginable. We learn of the carnage on the battlefields of World War I, as modern chemistry develops ever more debilitating gases to blind, maim, and kill the hapless combatants. An ominous new presence in this "war to end all wars" is the airplane, able to deliver death and destruction well behind enemy lines.

As war clouds gather again during the 1930s, nuclear physicists led by the Italian genius Enrico Fermi are busily bombarding various elements with neutrons, transmuting them into other elements. Late in 1938, German scientists Otto Hahn and Fritz Strassman prove that uranium decays by a process soon dubbed "fission," releasing 200 *million* electron volts per atom. Here is the vast energy Szilard had dreamt of. Worried that Nazi Germany might tap the same source to fuel a devastating bomb, Szilard helps convince Albert Einstein to write an urgent letter to President Roosevelt, triggering a sequence of events that culminates in the Manhattan Project several years later.

The first half of this long and engaging book is devoted to such preliminaries. Rhodes's portrait of the physicists and other major figures are sharp, sensitive, and literary. Bohr is a prominent presence throughout. His boyhood doubts and anxieties, annealed at college in the crucible of Danish moral philosophy, allow him to see beyond the seeming absurdities and paradoxes of quantum mechanics. According to his complementarity principle, there is no one way to look at nature. It is a multifaceted gem whose reality depends, in part, on the way we choose to observe it.

So when the possibility looms of a devastating weapon based on the recent insights of nuclear physics, Bohr is among the very first to see beyond its enormous destructive power to its promise as an instrument of world peace. While other scientists troop off to Los Alamos to solve the technical problems of building the bomb, he seeks out Churchill and Roosevelt, trying to establish the political foundations of a postwar world order based on openness and mutual control of this terrible artifact. "He made the enterprise which looked so macabre seem hopeful," wrote Robert Oppenheimer. "Every great and deep difficulty," Victor Weisskopf recalls Bohr saying, "bears in itself its own solution."

The End of Total War?

Rhodes makes certain his readers understand the already terrible capacity of the existing death machines in World War II. We grimace our way through grisly, explicit accounts of the firebombings of Hamburg, Dresden, and Tokyo in 1944-45. Hundreds of thousands of civilian lives were lost in those conflagrations, too, he

ILLUSTRATIONS: KAREN STOLPER

Science has profoundly shaped 20th-century politics, but scientists themselves have not.

notes, without a single nuclear weapon being dispatched. The bomb simply made this pre-existing practice far more efficient.

If there is any hope to be found in nuclear weapons, it is in the fact that they have finally made war *too* terrible to contemplate. This is their complementary aspect, which Bohr had grasped well before they became an objective reality. By their sheer destructive power, nuclear weapons have forced world leaders to find means other than war to resolve differences between nations.

Indeed, these revolutionary artifacts call into question the continued existence of nation-states, the true origin of so much carnage in our century. Rhodes devotes a brief section of his Epilogue to this important issue, suggesting that the world community of science, based on openness and free exchange, may provide a convenient model of how a modern world order might eventually operate.

Double-Edged Sword

Forty years later, we are still groping toward these ideals. Regional wars have become the norm—Korea, Vietnam, Israel-Egypt, Iran-Iraq, Afghanistan—with superpowers showing remarkable restraint as regards their own direct involvement. Though nations still bristle with weapons and continue spending billions on "defense," at least the nuclear genie has remained bottled. The summit meeting of December 1987 offers solid hope that nuclear arsenals may be sharply reduced in the near future, providing much-needed breathing space and building confidence that nations *can* work together to solve this century's most pressing problem. But any permanent solution may require that we see beyond the folly of today's nation-states to a new political order able to render nuclear weapons impotent.

Technology is a double-edged sword, and nuclear weaponry is no exception. Which edge gets used, and how, is always a matter of human *choice,* as Niels Bohr would have amply understood.

MICHAEL RIORDAN is a scientist at the Stanford Linear Accelerator Center and the author of The Hunting of the Quark, *a history of particle physics.*



From Lab to Soapbox

Beyond the Laboratory
By Peter J. Kuznick
University of Chicago Press, $29.95

Reviewed by Stuart W. Leslie

While science has had a profound role in shaping twentieth-century American politics, scientists themselves have not. Although forced to master the pork-barrel politics on which their own enterprise increasingly depends, American scientists have generally preferred the laboratory bench to the soapbox. Even when scientists have entered the political arena—the atomic scientists' movement after the Second World War, the environmental lobby of the 1960s, and the recent debates over creationism and the Strategic Defense Initiative—they have done so within rather narrow bounds. To speak out on wider issues, especially with a radical voice, has been to invite the ridicule of the scientific establishment. And so, with rare exceptions, what scientists have done has had far more political impact than what they have said or thought.

The one historical period to challenge this norm was the 1930s, as Peter Kuznick's *Beyond the Laboratory: Scientists as Political Activists in 1930s America* provocatively suggests. One need not agree with Kuznick's radical perspective to see how troubling the questions raised by his story are. Why were some prominent scientists so politically outspoken in those days? Why are so few any more? What price do we pay for their silence?

As Kuznick sees it, the 1930s were crucial for the American scientific community. Having grown accustomed to taking credit for the economic miracle of the 1920s, scientists suddenly found themselves blamed for the massive economic dislocations of the Great Depression. What's more, many scientists faced economic problems of their own. With severe cutbacks at academic, industrial, and government laboratories—more than half the staff at General Electric's research labs and at the National Bureau of Standards, for instance—and no job market in sight for new graduates, some scientists began questioning not only the social and political implications of their work but the political direction of the country as well.

As the Depression deepened, even conservative scientists began flirting with reform politics. M.I.T. president Karl Compton, frustrated in his efforts both to get the federal government to take science and science-policy matters more seriously and to revitalize M.I.T. in the midst of shrinking budgets, stopped arguing that "Science Makes Jobs." Instead he appealed to the government to "Put Science to Work" in a $75 million national public-employment program for scientists. Although such a proposal was no more radical than most other New Deal programs, it was clearly a departure from the standard attitudes in the scientific community.

By the late 1930s even the usually stodgy American Association for the Advancement of Science (AAAS) was paying serious attention to questions about the social implications of science and the social responsibilities of scientists. It organized a series of "Science and Society" conferences and elected several notable liberals to its presidency, including economist Wesley Mitchell and Harvard physiologist Walter Cannon. Reflecting on the significance of this, a number of national editorials suggested that it was about time that science shift its focus from what one termed "science for science's sake to science for the sake of humanity."

A few American scientists, inspired by the example of British colleagues like J.D. Bernal and J.B.S. Haldane, turned in more radical directions and looked to the Soviet Union as a model for the social organi-

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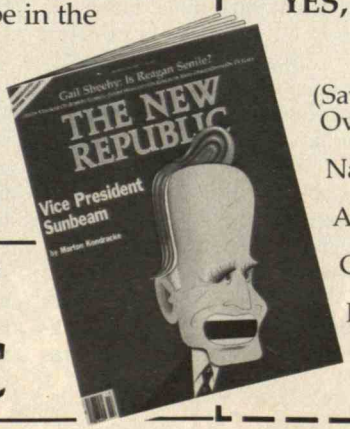
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zation and application of science. Although geneticist H.J. Muller, a future Nobel laureate, was exceptional in leaving the United States to take a position at the Institute of Applied Botany in Leningrad, even scientists of far more moderate views could not help but notice and comment upon the striking contrast between the place and position of science in the two nations. "In Soviet Russia," one observer noted, "science is elevated nearly to the level of a national religion."

Soviet priorities especially appealed to the biomedical community. At the Johns Hopkins Medical School, both Horsely Gantt, who had studied with Ivan Pavlov in the 1920s, and Henry Sigerist, a distinguished medical historian, became vocal and enthusiastic supporters of Soviet socialized medicine. Walter Cannon also spent time in the Soviet Union and spoke highly of his experiences there.

A small number of American scientists even ventured into direct political action and organization. At Columbia University, anthropologist Franz Boas, chemist Harold Urey, and others founded the University Federation for Democracy and Intellectual Freedom, a kind of public-interest group that monitored the accuracy of scientific information provided to the public. The group issued a Manifesto on Freedom of Science, signed by several Nobel laureates and dozens of members of the National Academy of Sciences.

Far more radical was the American Association of Scientific Workers, which called itself a "unifying body for all progressive-minded scientists." The organization was dedicated to defending the economic interests of scientific workers and seeking "a wider application of science and the scientific method for the welfare of society."

Kuznick points to such efforts as evidence that a significant element within the scientific community had progressed "beyond liberal reform" into radical politics. Had the scientists' movement survived the red-baiting and internal dissent of the post-war years, he argues, "it might have spawned a variety of home-grown radicalism with tremendous appeal to the American people and helped fashion a new scientific culture of abundance."

Beyond Liberal Reform?

Kuznick's history of the American scientific community reminds us that there were some whose social consciousness was not created in a flash at Hiroshima. However, he does leave the reader wondering whether the "radical" quotient of the scientific community can really be gauged by the efforts of a few highly visible activists.

A closer look at the participants in the organizations and conferences Kuznick describes reveals that he is talking about a relatively small cast of characters. Despite his assertions about a "growing consensus" for reform within the scientific community, he does not offer numbers convincing enough to prove that any significant percentage of the community was involved.

The fact is, most American scientists remained essentially conservative in those years. Their leaders were men like Robert Millikan and Frank Jewett, traditional conservatives who maintained their faith in private enterprise and initiative, and who viewed with distrust government involvement in science or economics. Some had campaigned actively for Hoover's election in 1928 and continued to support his programs right into the Depression. The Century of Progress World's Fair of 1933—with its slogan "Science Finds, Industry Applies, Man Conforms"—gave their political platform of an enlightened alliance between science and big business its most popular and tangible form. Kuznick mentions this conservative side of political activism only in passing, as if activism counts only when it is on the left.

Even Kuznick's most radical organizations look tame after more careful inspection. The activities such groups pursued included examining high-school texts for evidence of racism, debunking the claims of astrologers and mystics, setting consumers straight on advertising claims, and supporting world peace—worthy aims but hardly radical agendas, especially when compared with what was going on in other sectors of American life at the time, such as the labor movement.

Kuznick's evidence also suggests that it was the rise of Nazism, rather than the crisis of capitalism, that finally catalyzed the scientific community's social consciousness. At one point, he concedes that most of his "radicals" seemed far more interested in preserving democracy than in changing the economic system.

Finally, for a writer on the social history of science in the 1930s, Kuznick pays surprisingly little attention to American political radicalism outside the scientific community, whether on the left or the right. He makes no mention of Huey Long, even though science and technology were a critical part of his political platform. He completely dismisses Henry Wallace's reform programs which, though solidly New Deal, were at least as radical as most of the proposals Kuznick cites. Only the short-lived Technocracy movement, which proposed replacing politicians with engineers and money with a system of "energy units," captures Kuznick's interest. Unfortunately, he badly misinterprets it, failing to appreciate its right-wing—indeed, fascist—orientation

Continued on page 70

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FORUM

Continued from page 24

surement survey of 300,000 homes. That number of homes is necessary for adjusting by race, ethnicity, and geographic area.

Commerce Department Undersecretary Ortner stated that the survey would dilute census resources, and that adjustment would threaten customary legislative apportionment. He said adjustment would also raise suspicions about the census procedure's integrity. These objections are not compelling. Moreover, the last one could be used to disqualify the already adopted correction processes.

Since the statisticians who have studied the data have reached the consensus that the adjustment methods are reasonable, the Census Bureau is in a poor position to meet challenges to its numbers in 1990. No magic solutions will support the bureau's slogan that the 1990 census will be the best ever. On the contrary, more people are in hard-to-count groups now than in 1980. Consider the homeless. The undercount will be there; so will the lawsuits.

The decision against adjustment must be overturned. Legislation sponsored in 1987 by Congressman Mervyn M. Dymally (D-Calif.) and Senator Daniel Patrick Moynihan (D-N.Y.) would require the Census Bureau to adjust the numbers using the best methods available. This initiative should have bi-partisan support. The Census Bureau must provide the most accurate census figures possible. □

BOOKS

Continued from page 68

and its almost total lack of impact on practicing scientists and engineers.

Suffused with Business Values

So intent is Kuznick upon uncovering some deep strain of universal radicalism in the scientific community that he refuses to confront what may be the more important question: why were so few scientists willing to speak out?

In his book *The Revolt of the Engineers,* Edwin Layton has argued that the emerging social consciousness and political activism among American engineers just after the First World War never developed far because most engineers were less worried about professional autonomy and social responsibility than about more and better jobs. By placing private gain over public service in their teaching as well as their research, many engineering educators encouraged this myopic view.

Perhaps that has been true of science education no less than engineering. Kuznick says in passing that "science's dependence on corporate and philanthropic sources of support . . . encourag[ed] both an allegiance to the status quo and a suffusion of science with business values." But he takes this insight no further and thus fails to consider whether that arrangement acted to limit the political activism of scientists in the 1930s.

Today scientists and engineers seem even less interested in public affairs than they were a half-century ago, and proposals for the reform of science and engineering education abound. But loading the university catalogue with more humanities and social science courses won't magically produce socially responsible and socially committed scientists and engineers. Until a concern for social and political issues infuses the science and engineering curriculum itself, and the research and teaching of the faculty, public interest and public service will remain at the periphery of scientists' professional interest, to the detriment of us all.

STUART W. LESLIE is assistant professor in the Department of the History of Science at Johns Hopkins University.

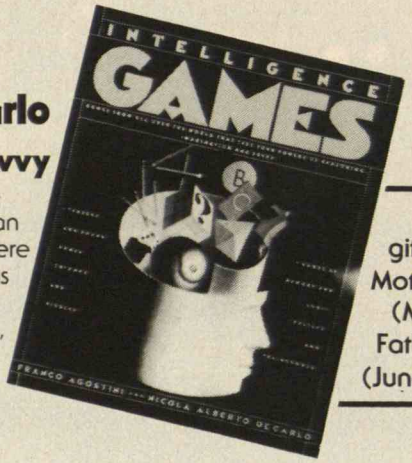
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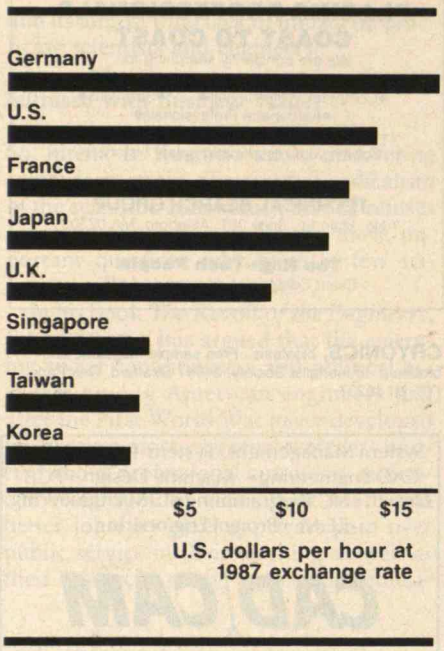
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World Economy in the Nineties

Watch the NICs

Three developments will dominate the world economy in the next decade, says M.I.T. economist Rudiger F. Dornbusch:
☐ The stagnation of many European economies because of their preoccupation with preventing inflation.
☐ Significant gains in the productivity of U.S. manufacturing relative to our European competitors and Japan.
☐ The rising competitiveness of the newly industrialized countries (NICs)—Korea, Brazil, Mexico, and Taiwan.

The NICs' big advantage is spectacularly low wages (*see chart*). In 1963 these nations accounted for 4.3 percent of world exports of manufactured products; 12 years later they were up to 12.4 percent. In the 7 years from 1980 to 1986, the United States' trade balance with the NICs went from +$26.1 billion to −$27.9 billion—a dramatic $50 billion drop.



Low wages in manufacturing industries are key to the success of the newly industrialized countries (NICs) in world trade. The continuing success of these nations will be a major factor in the world economy in the next decade, says M.I.T. economist Rudiger Dornbusch. NICs are enjoying annual growth rates in manufactured exports of at least 10 percent, and in 1986 Mexico's exports were up 48 percent over 1985.

What's Wrong with U.S. Manufacturing?

Why have so many U.S. industries fallen victim to overseas competition?

In a word, because of self-indulgence. We are impatient to enjoy the fruits of our labor. And all of us too often concentrate on "doing our own thing" instead of working with and helping each other.

This is a broad paraphrase of the results from the year-long first phase of a major study by an M.I.T. faculty Commission on Industrial Productivity. The project continues toward a final report, due late this year, whose main purpose will be to suggest actions that M.I.T. and other educational institutions—and the nation as a whole—must take to restore industrial competitiveness and productivity growth.

In its first report, delivered to the American Association for the Advancement of Science (AAAS) early this year in Boston, the commission summarized its studies of the recent histories of eight industrial sectors—semiconductors and computers, automobiles, steel, consumer electronics, chemicals and pharmaceuticals, textiles, machine tools, and commercial aircraft. It found five common, recurring weaknesses:
☐ Short time horizons, and a tendency to overemphasize short-term financial goals.
☐ Parochialism in management decision-making, frequently leading to inadequate attention to foreign markets and overseas competition. "We have developed as a people with almost no sense, or even vocabulary, for international economic relations and what they mean to us," said commission member Robert M. Solow, Nobel-laureate professor of economics.
☐ Artificial barriers within and between firms. These have prevented teamwork and fostered inefficiency.
☐ Poor use and planning of human resources. "Firms have tended to view labor more as a cost factor to be minimized than as a productive, evolving resource," says the report.
☐ The typical Japanese firm thinks of itself as "an alliance of workers, managers, and investors," said Solow. That doesn't happen in the United States.
☐ Weaknesses in technological practice that have either prevented exploitation of new technology or compromised the quality of products based on it.

Despite recent small gains in U.S. productivity, the commission's study is by no means obsolete, Dean Lester C. Thurow of the M.I.T. School of Management told the AAAS. The basic problem remains: "Production is too low on the totem pole in industry."

Even late last year, Thurow said, an industrial executive told him, "We're not sure we need smart people in manufacturing."

Toward Better Robots

In most robots powered by electric motors, gears translate the high-speed, low-power rotation of the motor into the lower-speed, higher-power rotation required for the robot. But the gears inevitably have friction that steals some of the robot's power and backlash—looseness between two gears—that reduces the robot's accuracy. Kamal Youcef-Toumi and Haruhiko Asada at M.I.T. have conquered these problems with a new technology of "direct drive" robots. The new machines use high-torque, variable-speed DC motors and other design innovations to increase power, variability, and accuracy. The two Japanese companies that sponsored the research are now adapting the results to commercial products, and direct-drive robots are the subject of a fast-selling book published for Youcef-Toumi and Asada by the M.I.T. Press.

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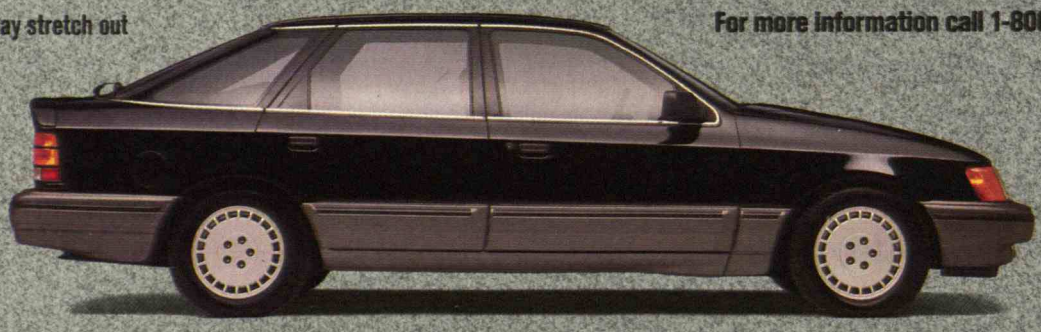
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